# 250X4/250X4 LF

Excavator

# SERVICE MANUAL

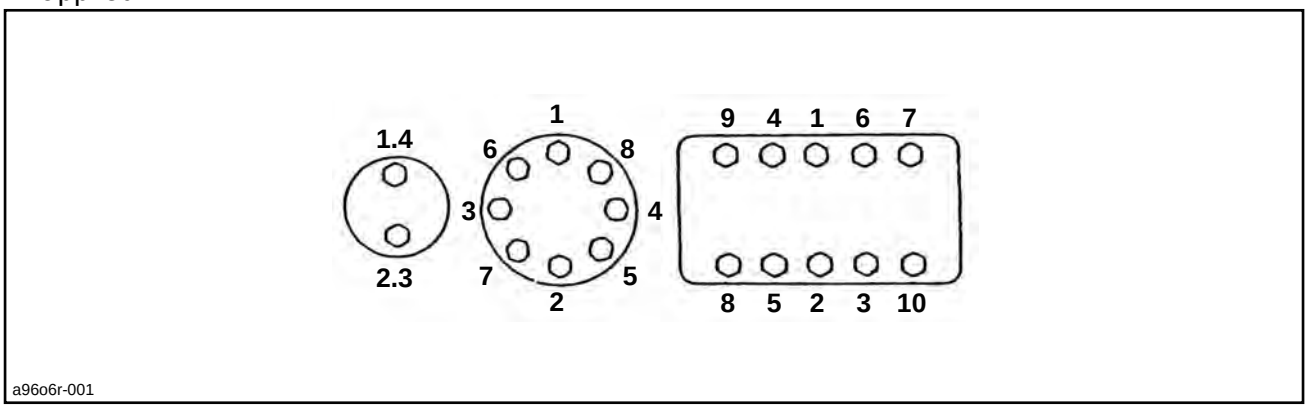
WLSM2507-08LX

Dec. 2015

# Standard Torque Data For Cap Screws And Nuts

## Bolt and Nut Tightening

- Tighten alternating between left and right and top and bottom so that uniform tightening force is applied.




- If Loctite was used on a removed bolt (there is something white sticking to the bolt when it is removed), clean the old Loctite off with cleaning fluid, dry the bolt, and then apply 2 - 3 drops of Loctite to the thread section of the bolt.

Torque list

| Bolt nominal diameter (size) | | | M6 | M8 | M10 | M12 | M14 | M16 | M18 | M20 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hexagon bolt | Wrench | mm (in.) | 10 (0.394) | 13 (0.512) | 17 (0.669) | 19 (0.748) | 22 (0.866) | 24 (0.945) | 27 (1.063) | 30 (1.181) |
| | Tightening torque | N·m (lbf·ft) | 6.9 (5.090) | 19.6 (14.459) | 39.2 (28.917) | 58.8 (43.376) | 98.1 (72.367) | 156.9 (115.743) | 196.1 (144.661) | 294.2 (217.028) |
| Hexagon socket head bolt | Wrench | mm (in.) | 5 (0.197) | 6 (0.236) | 8 (0.315) | 10 (0.394) | 12 (0.472) | 14 (0.551) | 14 (0.551) | 17 (0.669) |
| | Tightening torque | N·m (lbf·ft) | 8.8 (6.492) | 21.6 (15.934) | 42.1 (217.028) | 78.5 (57.909 | 117.7 (86.826) | 176.5 (130.202) | 245.2 (180.881) | 343.2 (253.175) |

B. Operating the parking brake (Diagram 16)
When the control valve is returned to the neutral position, the feed of pressure oil to the P1 port is cut off, and an attempt is made to stop the piston motor, because the "High-pressure selection shuttle valve function" explained in Item E of "[1] Double Counter Balance Valve" connects oil path D to motor case drain oil path F, the pressure oil in the parking brake cylinder chamber E (ac) is led to the motor case drain and the pressure drops.Therefore, the brake piston (3) is moved to the right side by the spring (4), the disks (1) are tightened with the force (ad) of the spring (4) by the brake piston (3) and motor case (ab), so the piston motor shaft is locked and the parking brake operates.

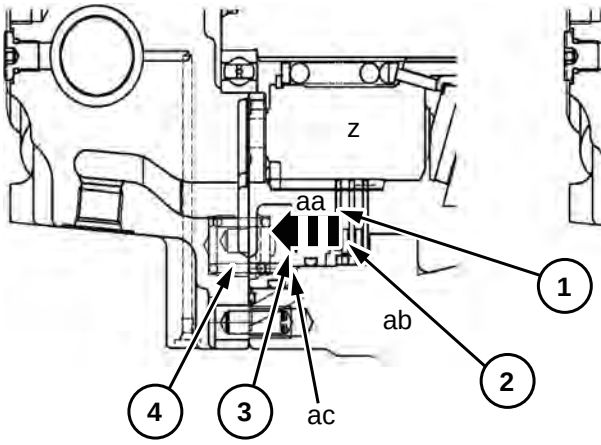



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Diagram 15 Parking brake released state

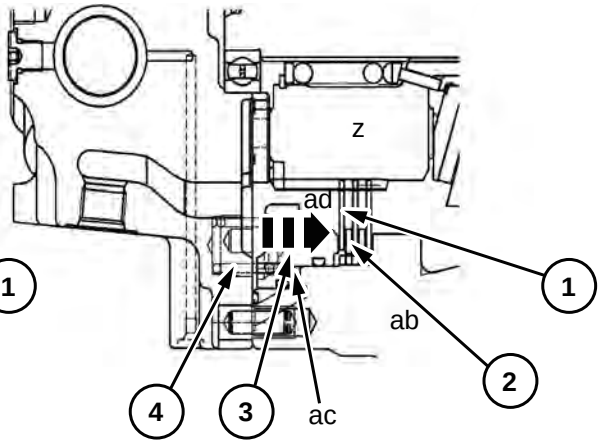
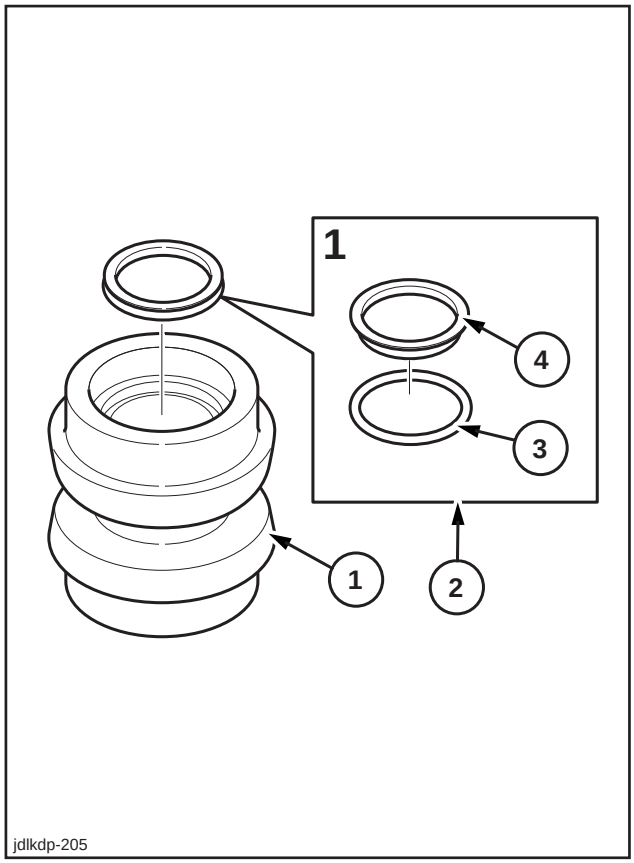



Diagram 16 Parking brake engaged state

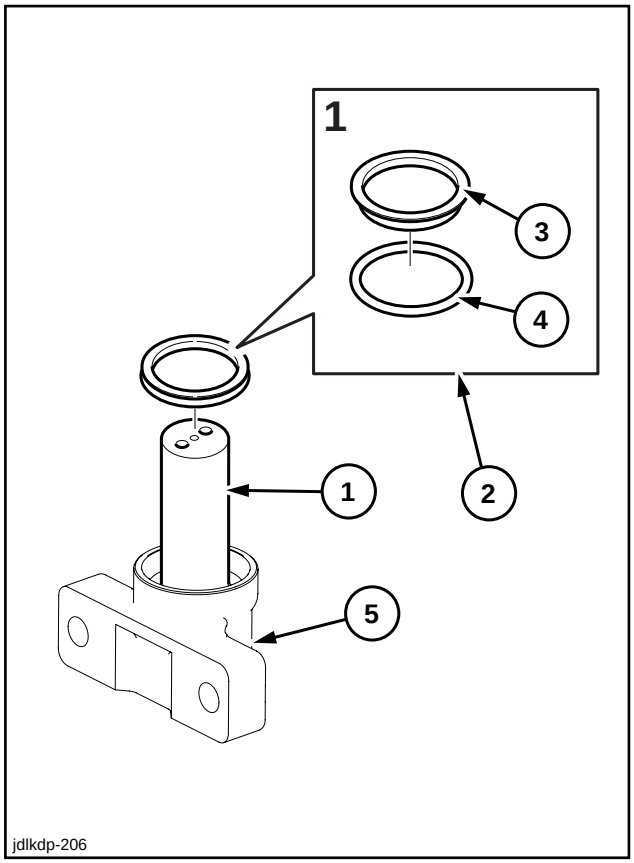
Piston Motor

The "piston motor" is a swash plate-type piston motor that converts the fluid energy of the pressure oil sent from the hydraulic pump into mechanical energy and outputs high-speed, low-torque power.
A swash plate-type piston motor is used as the piston motor.
Diagram 17 shows a structural diagram of the piston motor.
9 pistons (4-2) are incorporated in the cylinder block (4-1) and the end of the cylinder block (4-1) touches a valve plate (22) that has 2 sausage-shaped ports, B and C. The pressure oil discharged from the hydraulic pump flow in from the P1 port or the P2 port and while the piston motor rotates, flows out from the P2 port or P1 port.
Also, the drain oil in the case that has leaked from the sliding sections and the gap returns to the hydraulic tank from the base plate (2-1) T1 or T2 port.

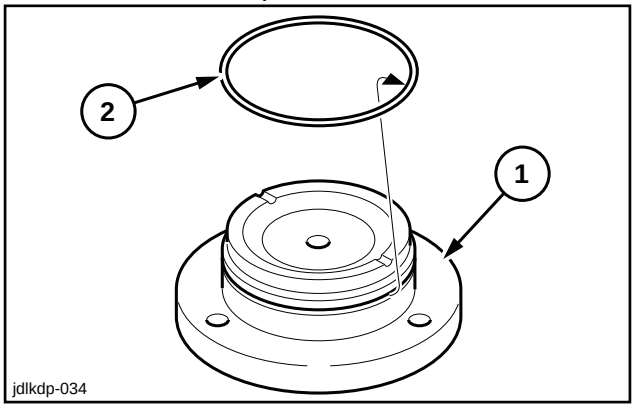
1. The high-pressure oil from the P1 port enters the valve plate (22) sausage-shaped B port, the piston (4-2) is pressurized, and the top of the swash plate (5) rotates and moves from top dead center to bottom dead center.
2. The P2 port becomes the low-pressure side and while the piston (4-2) rotates and moves from bottom dead center to top dead center, the oil is discharged to the P2 port via the valve plate (22) sausage-shaped C port.
3. Accompanying the reciprocal movement of the piston (4-2), the cylinder block (4-1) and the shaft (3) spline coupled to it rotate in the counter-clockwise direction of the arrow in the diagram.
4. When the piston motor rotates clockwise, the P1 port side becomes the low-pressure side and the P2 port side becomes the high-pressure side.



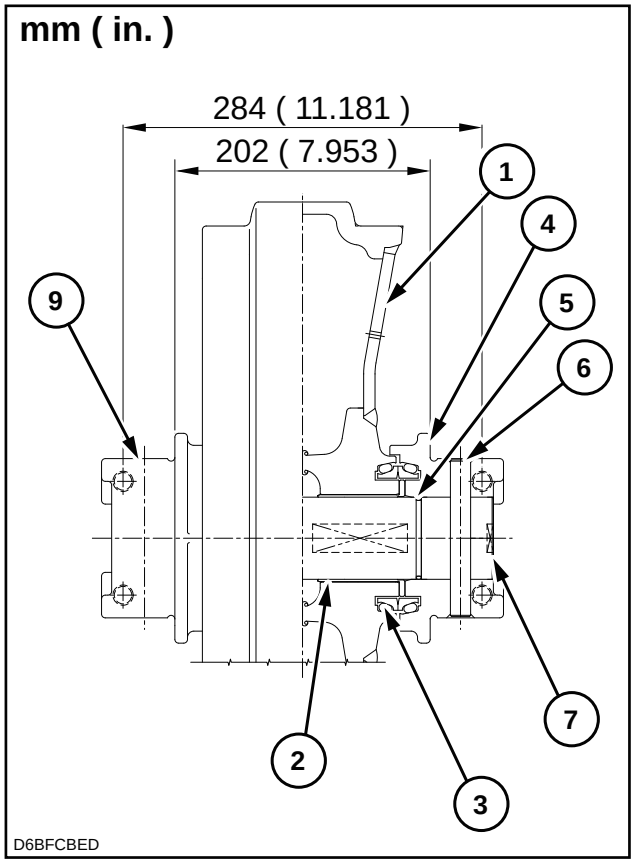

8. Remove the floating seal (2) on the shaft (1).
   - The shaft and bracket (5) cannot be removed.
     Check whether the sliding surface has rusted or is damaged. Also make sure the O-ring (4) on the seal ring (3) is not twisted.



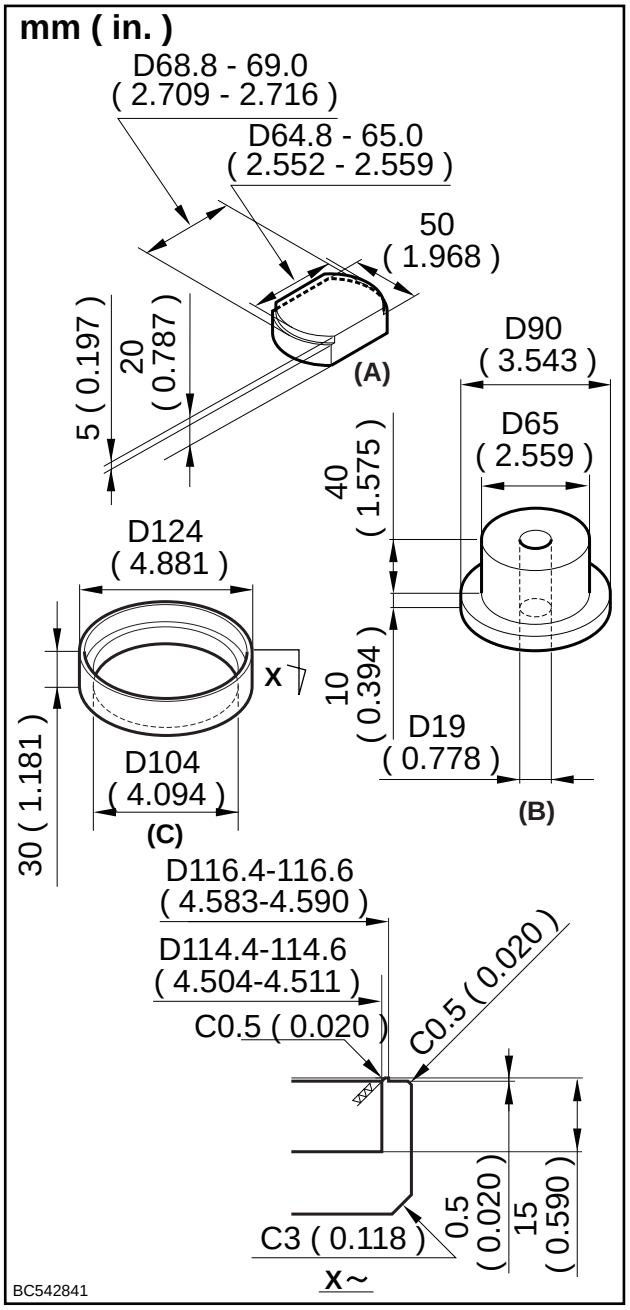

9. Remove the O-ring (2) on the cover (1) side.
   - Check whether the O-ring is twisted. If it is twisted, replace it with a new one.



## Dimension Diagram




## Jig Dimension Diagram

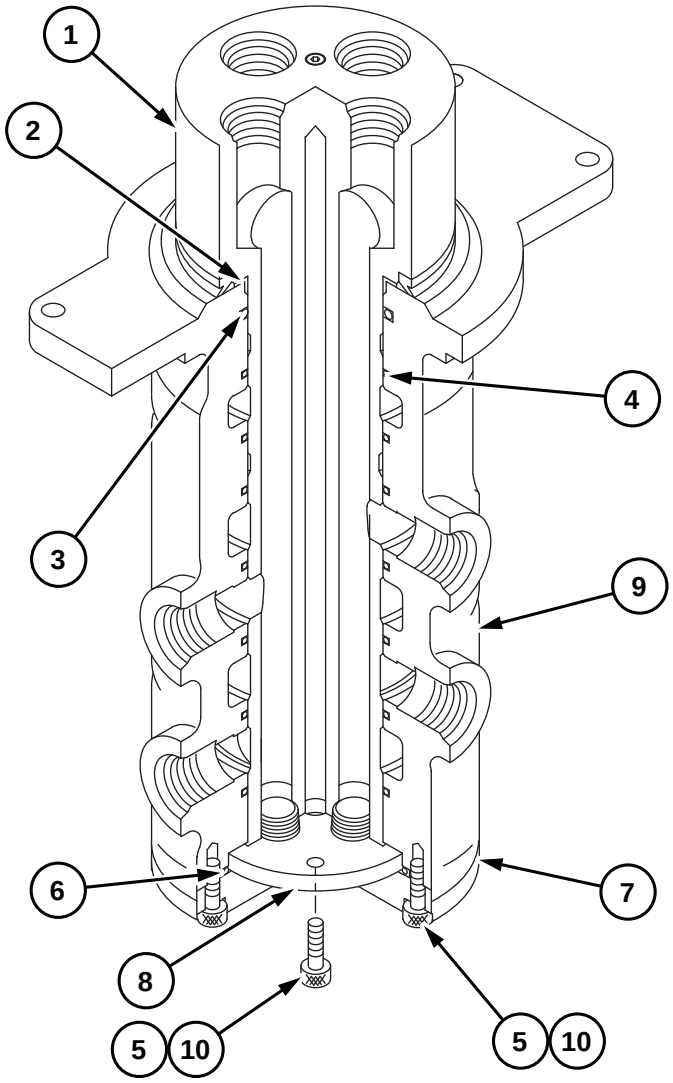



| | |
|---|---|
| A | Bushing removal jig |
| B | Bushing press-fit jig |
| C | Floating seal installation jig |

## Disassembly Procedures

1. After cleaning the roller with kerosene, use the hexagon wrench (1) to remove the plug (2) from the hub (3).
   - The plug is coated with seal nylon, which comes off when the plug is removed. Seal tape is necessary for reusing.

## Configuration Diagram

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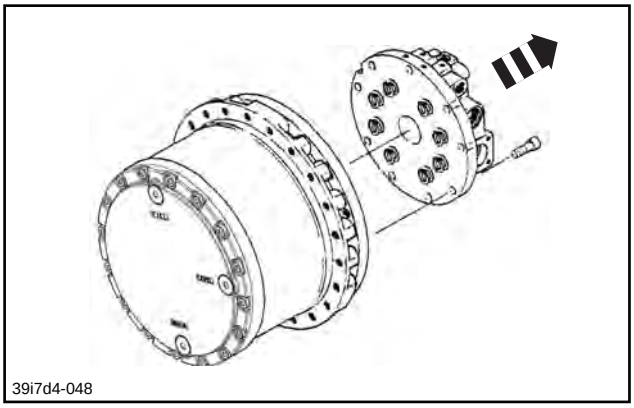
| Code | Part name | Code | Part name | Code | Part name |
|---|---|---|---|---|---|
| 1 | Axle | 5 | Hexagon socket head bolt | 9 | Rotor |
| 2 | V-ring | 6 | O-ring | 10 | Loctite |
| 3 | O-ring | 7 | Cover | | |
| 4 | Packing ring | 8 | Thrust plate | | |

7. Removal of base plate
   Loosen hexagon socket head bolts (1-11) to remove the base plate (1-2-1).

⚠ Caution

Pay attention to the following cautions during the work to remove the base plate.

1. The base plate is pushed down by the spring (1-18).
   Therefore, the hexagon socket head bolt shall be loosened evenly.
2. The pin (1-19) for positioning is attached between the base plate and the main unit.
   Thus, the base plate (1-2-1) should be removed straight along center line of the motor so as to avoid twisting the pin.
   If it is twisted, straighten them again by tapping the base plate with a plastic hammer to resume normal condition of the pin and then try again.
3. The valve plate (1-21) comes out together with the base plate.
   Pay attention not to drop the valve plate on the sliding surface of the valve plate since it is a vulnerable portion.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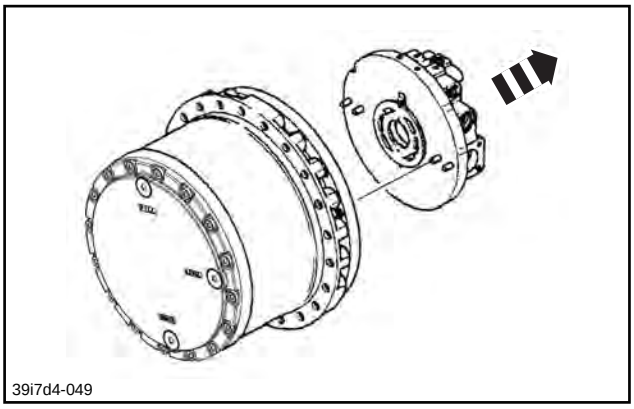
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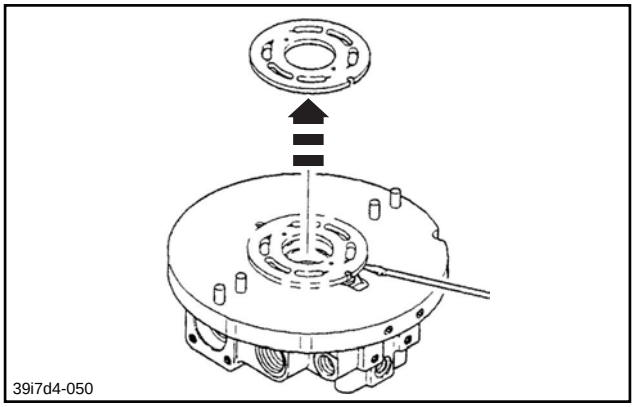
8. Removal of valve plate
   Remove the valve plate (1-21) from the base plate (1-2-1) with a flathead screwdriver.

⚠ Caution

Pay attention to the following cautions during the work to remove the valve plate.

1. The sliding surface of the valve plate is a vulnerable portion.
   Damaging the sliding surface may disturb the specified performance so that pay attention not to damage it.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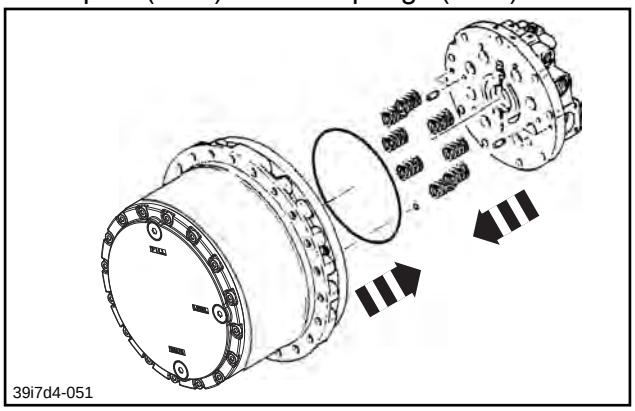
9. Removal of O-ring, pin and spring
   Remove the O-rings (1-22) (1-23), the pins (1-19) and the springs (1-18).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10. Removal of brake piston
    Attach a nozzle of air compressor to brake oil piping for the parking brake on the flange (1-1), and then blow compressed air pressure into the cylinder chamber of the parking brake to raise the brake piston (1-15) and then remove it.
    After removing the brake piston, remove the disk plate (1-13) and the friction plate (1-14) to remove the D-ring (1-16) (1-17).

2. Assembly of motor part

[1] Assembly of oil seal

Confirm that the oil seal (1-12) is not attached to the flange (1-1), and if it is not attached, then press-in the oil seal to the flange using a press-in jig for oil seal.

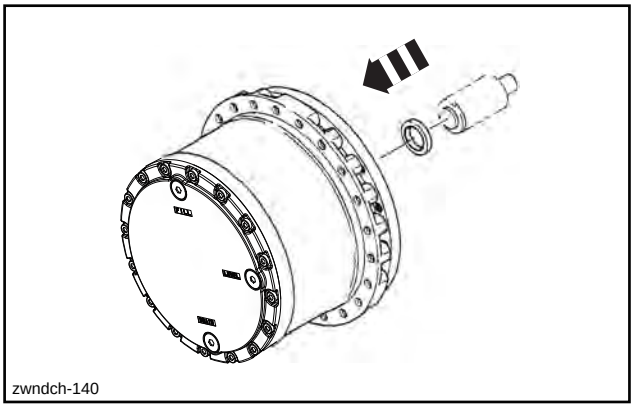
**Caution**

1.It should be pressed-in after applying grease on inner diameter surface of the flange to which the oil seal is pressed-in and on the outer diameter surface of the oil seal.

2.Press-in after applying greaser on inner diameter lip portion of the oil seal.

3.It should be pressed-in due vertically with a pressing machine.
Any incline may damage outer diameter surface of the oil seal.

4.Pay attention not to damage inner diameter surface lip portion of the oil seal during press-in.
Damaging there may cause oil leakage which may damage inside the reduction gear during motor operation.



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[2] Assembly of piston assembly

Assemble the springs (1-20) to holes of the flange (1-1) to which the piston assemblies (1-7) are assembled.
Then, assemble the piston assemblies to the flange.

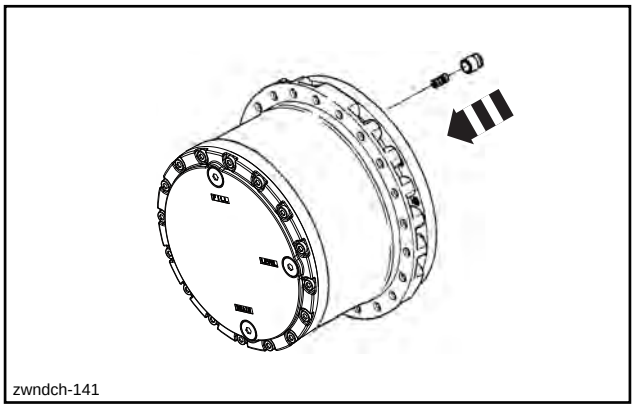
**Caution**

1.The springs should be assembled at the center of the holes.

2.The piston assemblies are to be assembled in a manner so as to point their cylinder portions downward.

3.Apply hydraulic fluid on inner diameter surface of mounting holes of the flange and on outer circumference of cylinder portions of the piston assemblies before assembling the piston assemblies.

4.Check smooth movement of the piston assemblies after assembling them.



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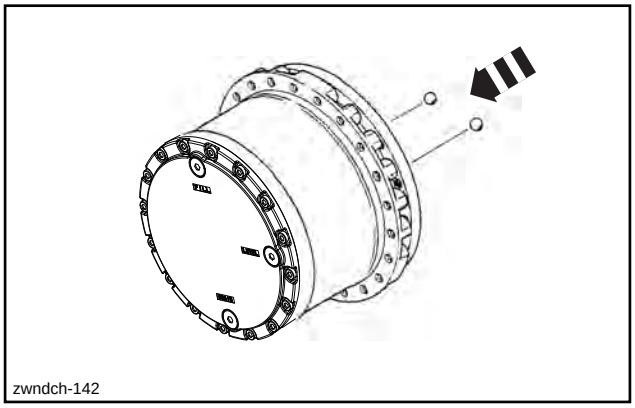
[3] Assembly of steel ball

Assemble the steel balls (1-6) to ball holes of the flange (1-1).

**Caution**

Apply hydraulic fluid on inner diameter surface of ball holes of the flange and steel balls before assembling the steel balls.



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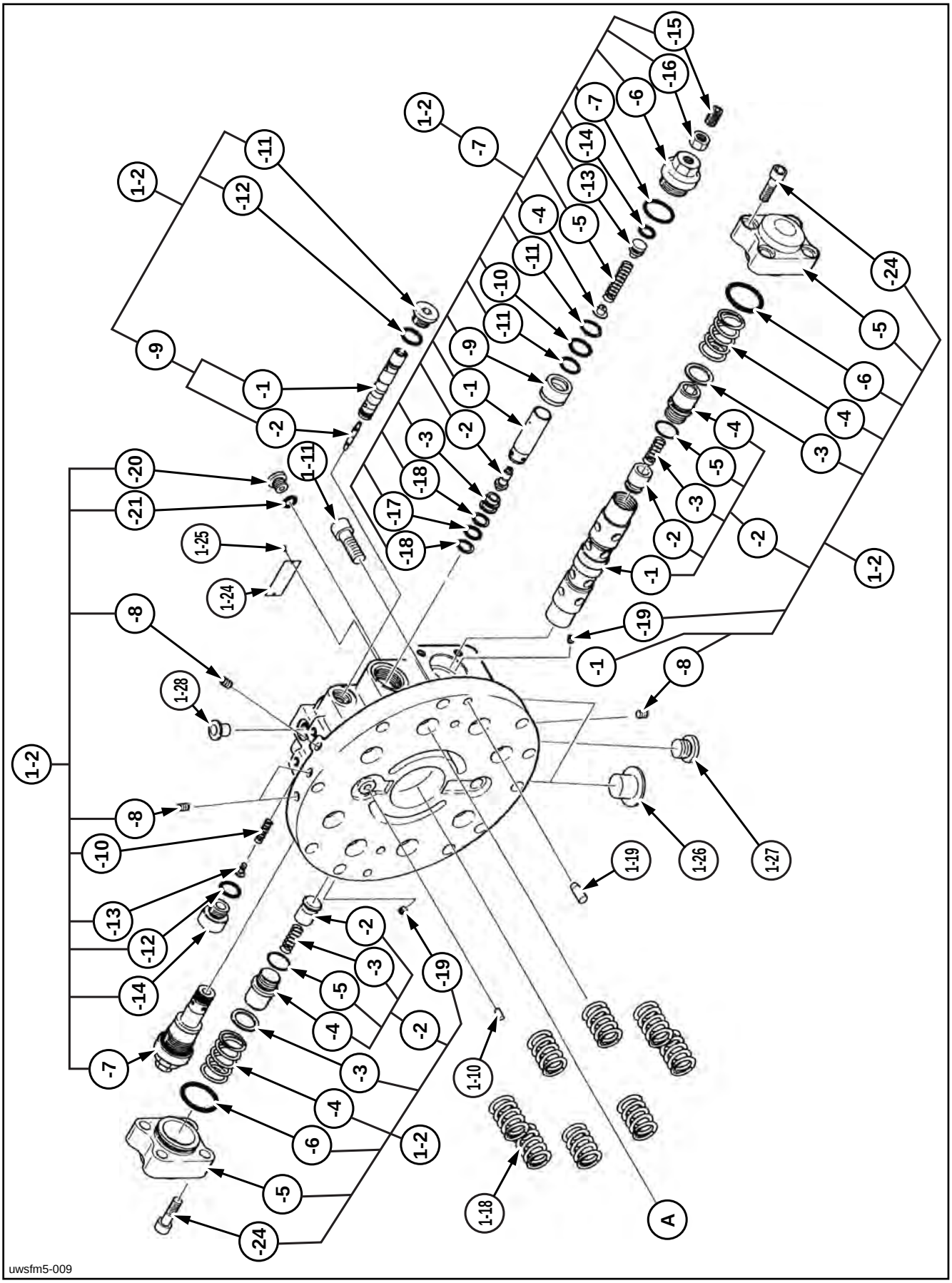
## Structural Diagram



# B. C. SWING UNIT, COUNTERWEIGHT

## Removal and Installation of Swing Unit

**Warning**

- Make sure to release hydraulic pressure before starting work.

**Caution**

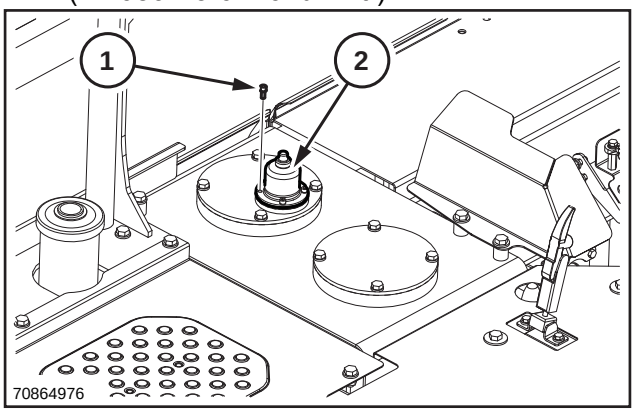
- Make sure to stop the engine before starting work.
- Make sure to check slinging apparatus such as a wire rope before starting work.
- Never allow any person to enter underneath a slung load.
- Any equipment in this product must be removed after the system of the equipment stops and surface temperature of the product drops to approximately 40 °C (104.0°F) or less. Working on the products with high temperature may cause burn injury. Make sure to bleed pressure before removing any piping from the product. Removing piping with pressure in line may cause oil to blast out, which may lead to injury or oil leakage.

Items to prepare

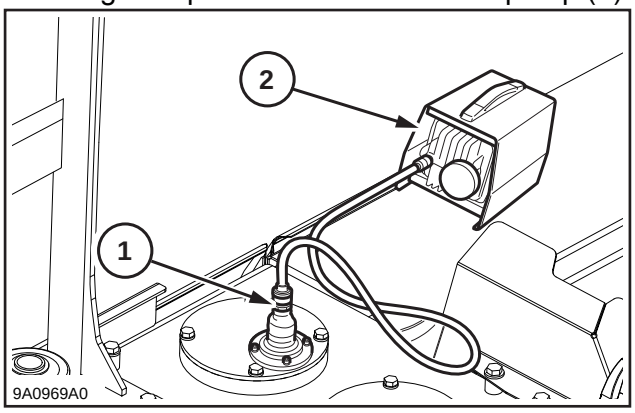
- Wrench [13 mm (0.512 in.), 14 mm (0.551 in.), 19 mm (0.748 in.), 22 mm (0.866 in.), 27 mm (1.063 in.), 36 mm (1.417 in.), 41 mm (1.614 in.)]
- Hexagon wrench [5 mm (0.197 in.)]
- Box wrench [36 mm (1.417 in.)]
- Pliers
- Hammer
- grease
- Dedicated adapter for connecting vacuum pump
- Vacuum pump (power supply for vacuum pump)
- extension cable
- Wire rope (that fulfills breaking load)
- Marking pen
- Cap
- Plug
- Liftcrane (that fulfills slinging capacity)
- Rag
- Cleaning fluid
- Wood plank

### Removal of Swing Unit

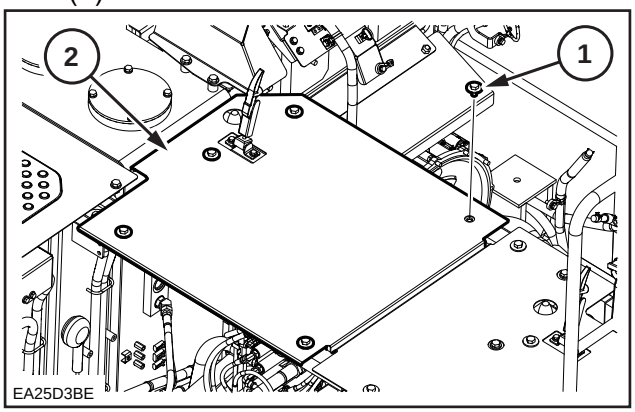
1. Open the engine hood cover.
2. Remove the 4 bolts (1) with a hexagon wrench [5 mm (0.197 in.)] to remove the air breather (2) of the hydraulic reservoir.
   Bolt tightening torque: 2.94 - 4.90 N・m (2.1689 - 3.6146 lbf・ft.)




3. Mount the dedicated adapter (1) at the location from which the air breather has been removed and then set the vacuum pump.
   Keep inside of the hydraulic reservoir in negative pressure with a vacuum pump (2).

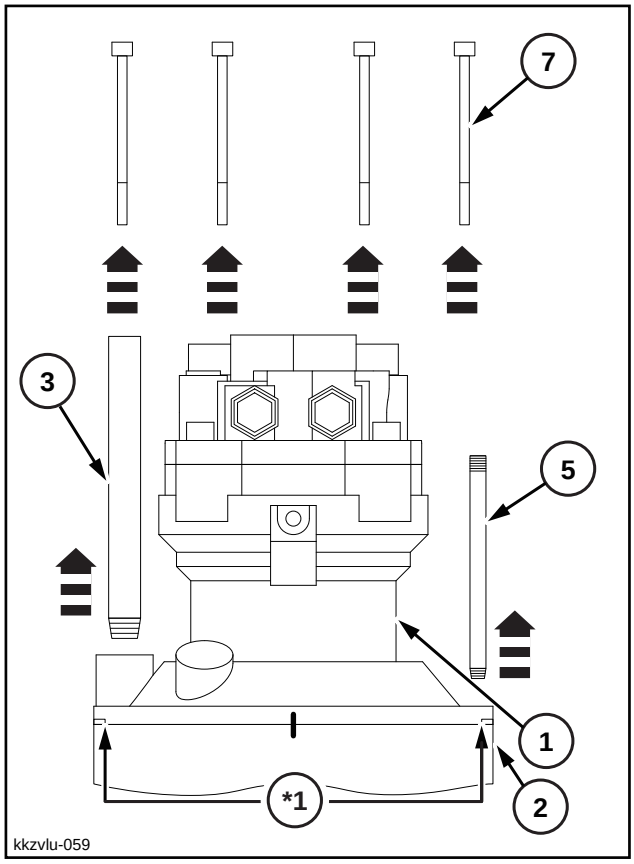



4. Remove the 5 bolts (1) with a wrench [19 mm (0.748 in.)] to remove the center cover (2).



Use the make-up port (G1) to raise the motor and remove it.

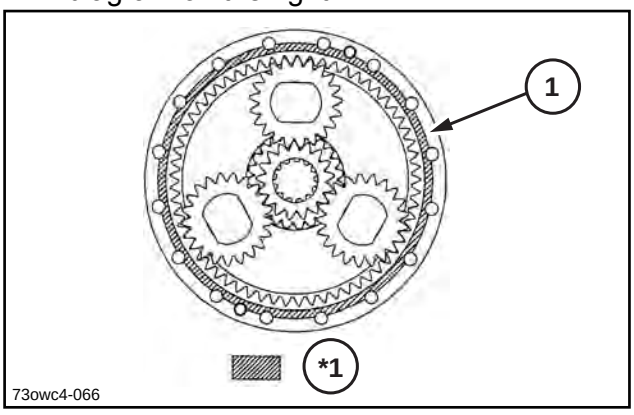
- Liquid packing has been applied to the matching surface of the casing K1 (1) and ring gear (2), so use the notch sections (*1) in the diagram on the right to remove the motor.



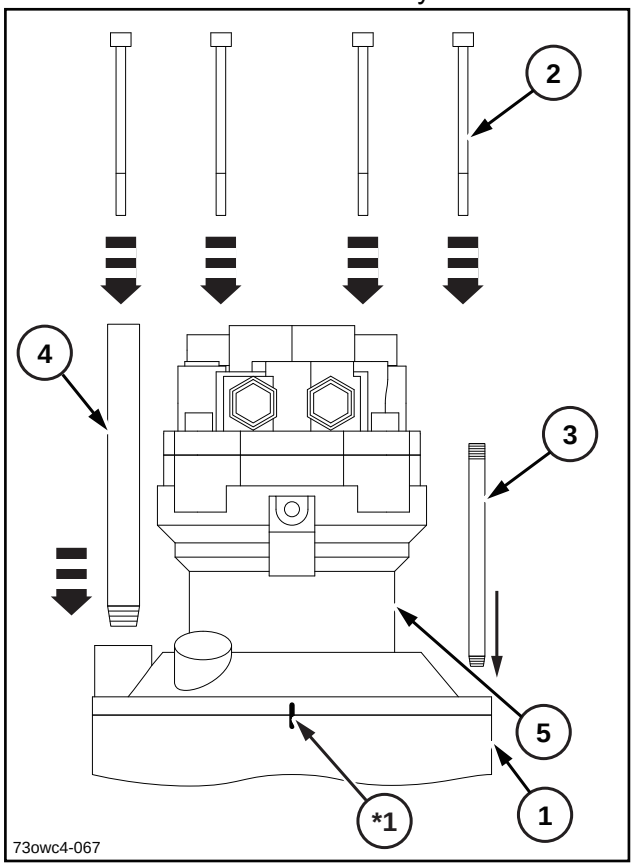

This completes the disassembly.

## Assembly

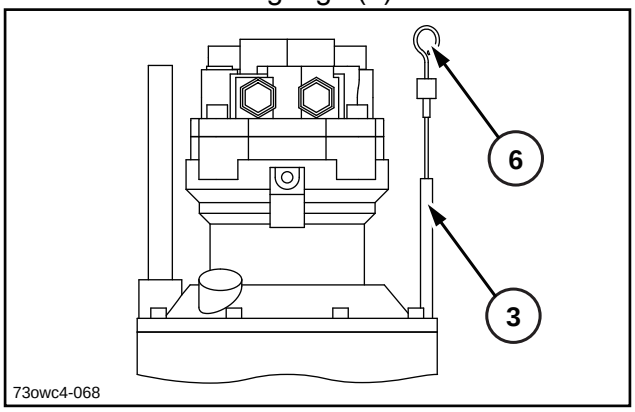
1. Application of liquid packing
   After cleaning and degreasing the reduction gear ring gear (1) and the motor casing K1 (5) matching surfaces, apply (*1) liquid packing (ThreeBond Co.,Ltd. "1215" gray or the equivalent) as shown in the diagram on the right.




2. Motor installation
   Lift the motor and softly install it in the reduction gear, and tighten the hexagon socket head bolts (2) [10 mm (0.394 in) hexagon diameter)] to the tightening torque of 90 N·m (66.39 lbf·ft).
   Install pipes (4) and (3).
   - Align the casing K1 (5) and ring gear (1) according to the reference mark (*1) made before disassembly.




3. Installation of level gauge
   Insert the level gauge (6).




4. Gear oil filling
   Tighten the plug of the oil drain hose.

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3. Table

Refer to the following table for the angle, voltage, and degree of opening of each detent position.

| detent | Angle [deg] | Voltage [V] | Degree of opening [%] |
|---|---|---|---|
| 1+ | 131.2 | 4.86 | 100.0 |
| 1 | 128.7 | 4.77 | 98.0 |
| 1- | 126.2 | 4.67 | 96.1 |
| 2+ | 109.6 | 4.06 | 83.0 |
| 2 | 107.1 | 3.97 | 81.1 |
| 2- | 104.6 | 3.87 | 79.1 |
| 3+ | 95.2 | 3.53 | 71.7 |
| 3 | 92.7 | 3.43 | 69.8 |
| 3- | 90.2 | 3.34 | 67.8 |
| 4+ | 88.0 | 3.26 | 66.1 |
| 4 | 85.5 | 3.17 | 64.1 |
| 4- | 83.0 | 3.07 | 62.2 |
| 5+ | 80.8 | 2.99 | 60.4 |
| 5 | 78.3 | 2.90 | 58.5 |
| 5- | 75.8 | 2.81 | 56.5 |
| 6+ | 73.6 | 2.73 | 54.8 |
| 6 | 71.1 | 2.63 | 52.8 |
| 6- | 68.6 | 2.54 | 50.9 |
| 7+ | 66.4 | 2.46 | 49.1 |
| 7 | 63.9 | 2.37 | 47.2 |
| 7- | 61.4 | 2.27 | 45.2 |
| 8+ | 59.2 | 2.19 | 43.5 |
| 8 | 56.7 | 2.10 | 41.5 |
| 8- | 54.2 | 2.01 | 39.6 |
| 9+ | 52.0 | 1.93 | 37.8 |
| 9 | 49.5 | 1.83 | 35.9 |
| 9- | 47.0 | 1.74 | 33.9 |
| 10+ | 44.8 | 1.66 | 32.2 |
| 10 | 42.3 | 1.57 | 30.2 |
| 10- | 39.8 | 1.47 | 28.3 |
| 11+ | 37.6 | 1.39 | 26.5 |
| 11 | 35.1 | 1.30 | 24.6 |
| 11- | 32.6 | 1.21 | 22.6 |
| 12+ | 30.4 | 1.13 | 20.9 |
| 12 | 27.9 | 1.03 | 18.9 |
| 12- | 25.4 | 0.94 | 17.0 |
| 13+ | 23.2 | 0.86 | 15.2 |
| 13 | 20.7 | 0.77 | 13.3 |
| 13- | 18.2 | 0.67 | 11.3 |
| 14+ | 16.0 | 0.59 | 9.6 |
| 14 | 13.5 | 0.50 | 7.6 |

| | | | Inducement start time | | | |
|---|---|---|---|---|---|---|
| | | | First time | | Repeated | |
| Operation condition | Trouble diagnosis name | DTC | Early | Final | Early | Final |
| NCD-target component failure | Suction air temperature sensor abnormally low voltage | P0112 | 3 hours | 3.5 hours | Instantly | 30 minutes |
| | Coolant temperature sensor abnormally high voltage | P0118 | | | | |
| | Coolant temperature sensor abnormally low voltage | P0117 | | | | |
| | Boost pressure sensor abnormally high voltage | P0238 | | | | |
| | Boost pressure sensor abnormally low voltage | P0237 | | | | |
| | Common rail pressure sensor abnormally high voltage | P0193 | | | | |
| | Common rail pressure sensor abnormally low voltage | P0192 | | | | |
| | Airflow sensor abnormally high voltage | P0103 | | | | |
| | Airflow sensor abnormally low voltage | P0102 | | | | |
| | Airflow sensor flow abnormality | P0101 | | | | |
| | DCU communication abnormality | U010E | | | | |
| EGR system failure | EGR position sensor abnormality | P0409 | 36 hours | 100 hours | Instantly | 5 hours |
| | EGR2 position sensor abnormality | P140B | | | | |
| | EGR valve control abnormality | P0404 | | | | |
| | EGR2 valve control abnormality | P045B | | | | |
| | EGR 0-point learning abnormality | P1404 | | | | |
| | EGR2 0-point learning abnormality | P140C | | | | |
| | EGR flow abnormality | P0401 | | | | |

b. Inducement judgment

Inducement judgment differs between the "remaining urea level" and the "trouble diagnosis (including others)."

Remaining urea level: Inducement level is determined by the remaining level.

Trouble diagnosis: Inducement is determined by the operating hours that have passed since a trouble diagnosis was established.

There are also two types of stages in the judgment based on a trouble diagnosis.

(1) If an operation condition occurs in normal mode.

(2) If an operation condition recurs within the predetermined time after it occurs. (Repeat offense (Repetition))

Processing and judgment time differ between (1) and (2).

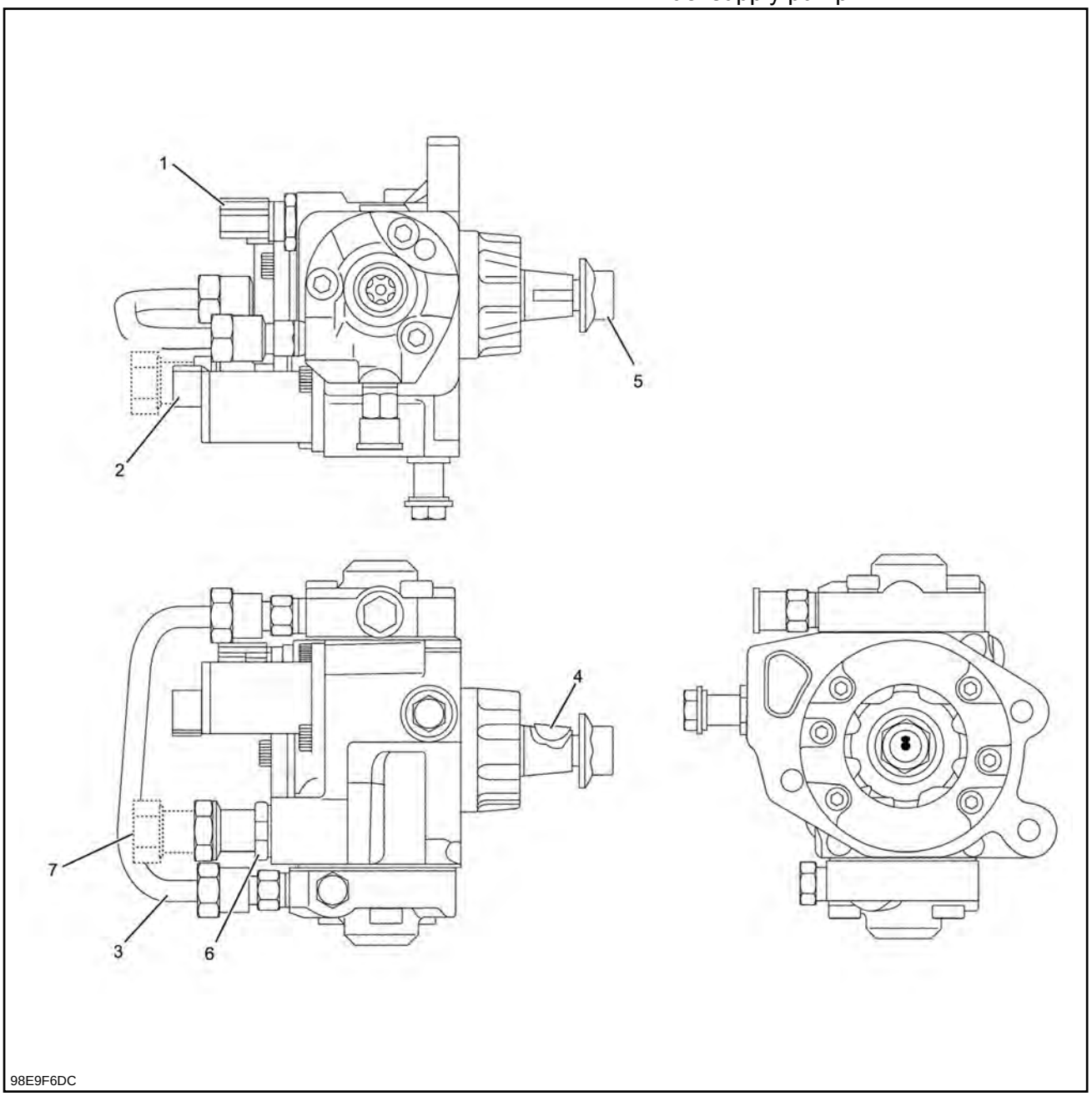
a) Judgment in normal mode

The concept of judgment flow is as follows. Since this is just a concept, the actual control logic differs a little. It also differs according to the operation condition.

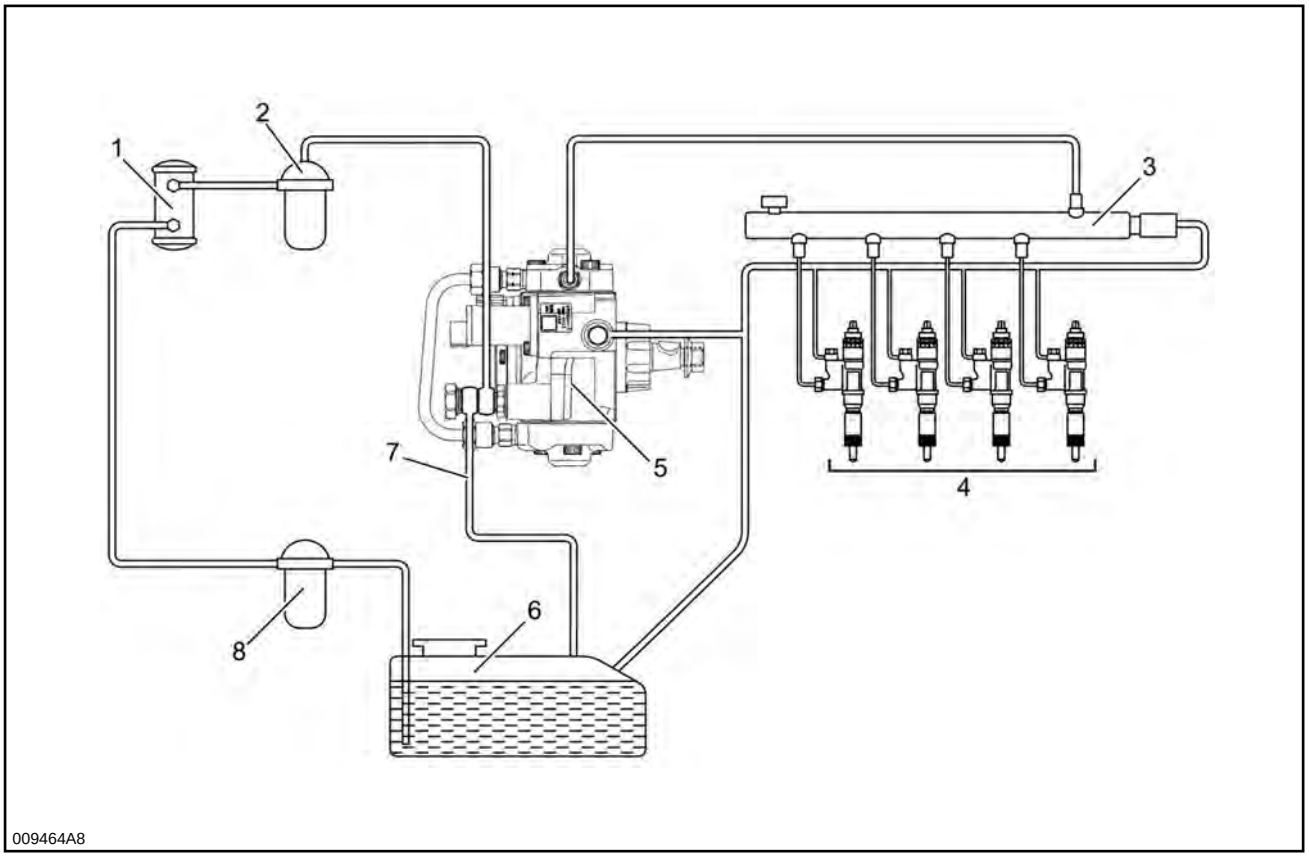
Remaining urea level

| Step | Judgment condition in normal mode | Yes | No |
|---|---|---|---|
| 1 | Since the key was ON, 4 seconds have passed, and also DCU-ECM communication is normal. | To step 2 | Status quo maintained |
| 2 | The remaining urea level remains 0% for 10 seconds. | Final Inducement triggered | To step 3 |
| 3 | The remaining urea level remains 5% or less for 10 seconds. | Early Inducement triggered | To step 4 |

Fuel supply pump




| | | | | | |
|---|---|---|---|---|---|
| 1 | Fuel temperature sensor | 4 | Camshaft key | 7 | Joint bolt |
| 2 | Suction control valve | 5 | Camshaft nut | | |
| 3 | High pressure pipe | 6 | Union | | |




| | | | | | |
|---|---|---|---|---|---|
| 1 | Electromagnetic pump | 4 | Fuel injector | 7 | Fuel return pipe |
| 2 | Fuel filter | 5 | Supply pump | 8 | Pre-fuel filter |
| 3 | Common rail | 6 | Fuel tank | | |

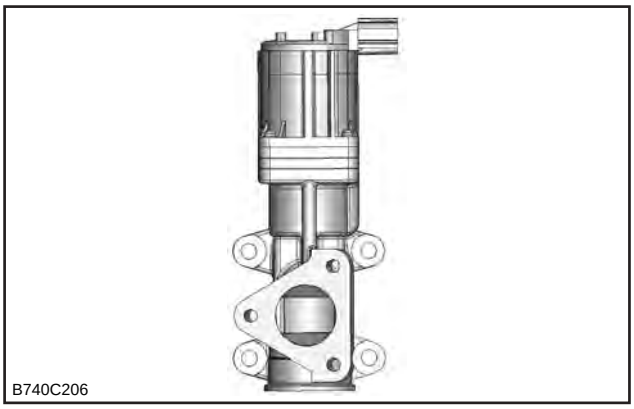
Removing air from the fuel system
Place an appropriate pan under the air removal plug.
Turn the ignition switch ON, and activate the electromagnetic pump.
Loosen the air removal plug of the fuel filter sufficiently, and operate the priming pump 20 times or more until the fuel comes out from near the plug.
Tighten the plug, and operate the priming pump 10 times or more until the fuel permeates.

Wait for approx. 1 minute, and then loosen the plug to remove the air in the fuel filter. This should be repeated at least 3 times until no air comes out from the plug. Securely tighten each plug, and wipe up any fuel spilled in the vicinity. Operate the priming pump 10 - 15 times until the fuel permeates and is fed to the engine.

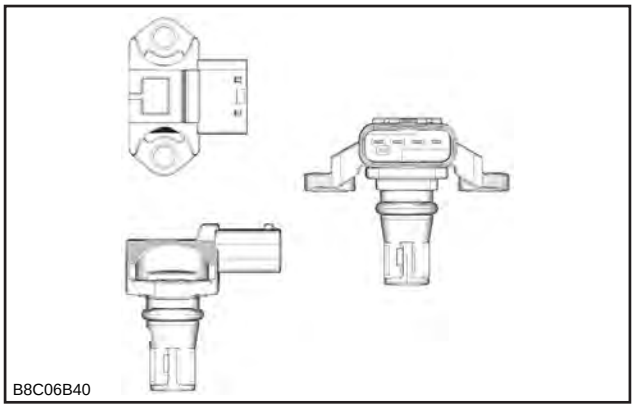
EGR position sensor
This sensor is installed inside the EGR valve to detect the EGR valve lift amount.

Note

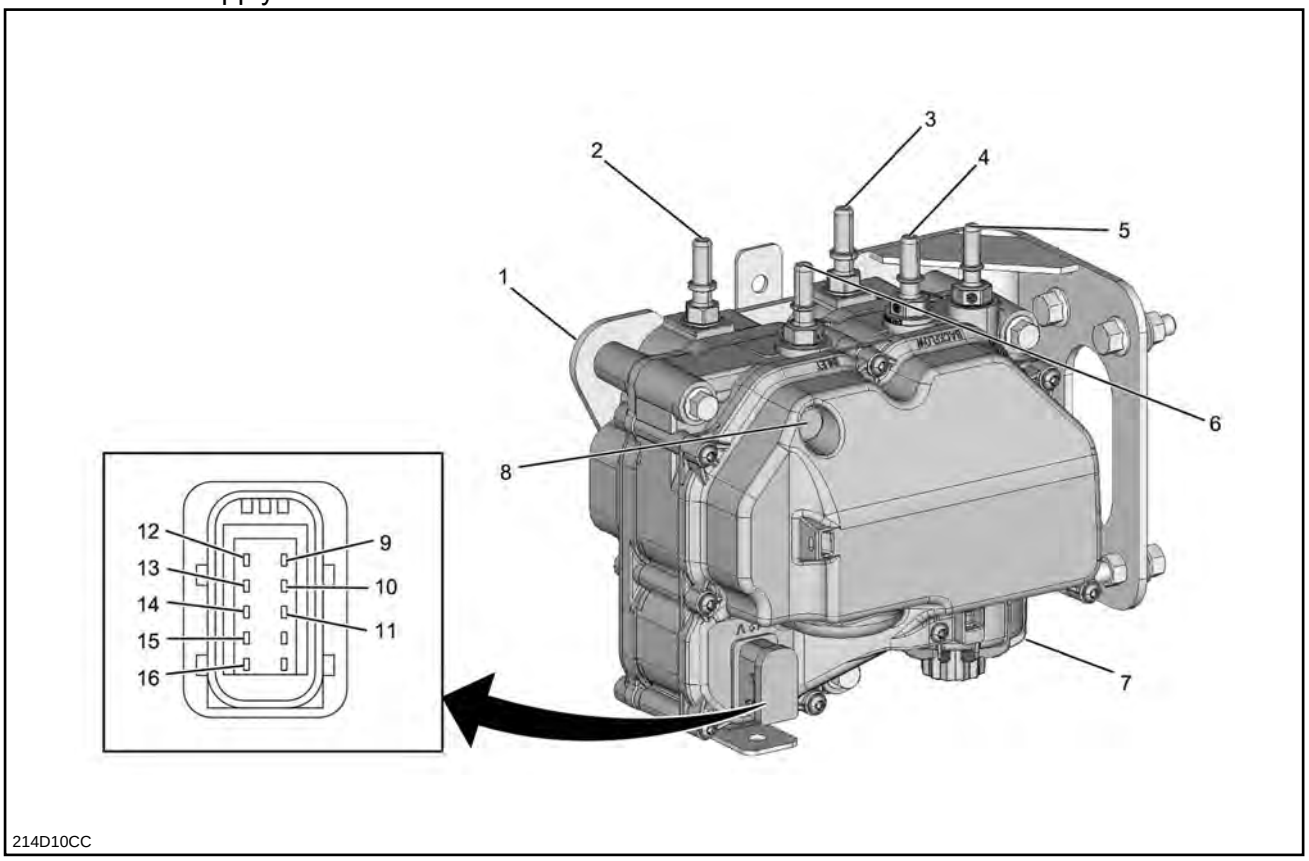
・Do not disassemble the EGR position sensor. When an abnormality is found, replace the EGR valve assembly.




Boost pressure sensor/boost temperature sensor
Boost pressure sensor
The boost pressure sensor detects the boost pressure of the intake pipe and converts the pressure into a voltage signal to send to the ECM. The voltage becomes higher when the pressure is higher, and it becomes lower when the pressure is lower. The ECM calculates the boost pressure from the voltage signal sent from the sensor and uses it to control the fuel injection, etc.Boost temperature sensor The boost temperature sensor measures the temperature of air entering the intake pipe. When the sensor is cold, the sensor resistance is high. As the air temperature rises, the sensor resistance decreases. The ECM detects a high voltage in the signal circuit when the sensor resistance is high. The ECM detects a low voltage in the signal circuit when the sensor resistance is low.



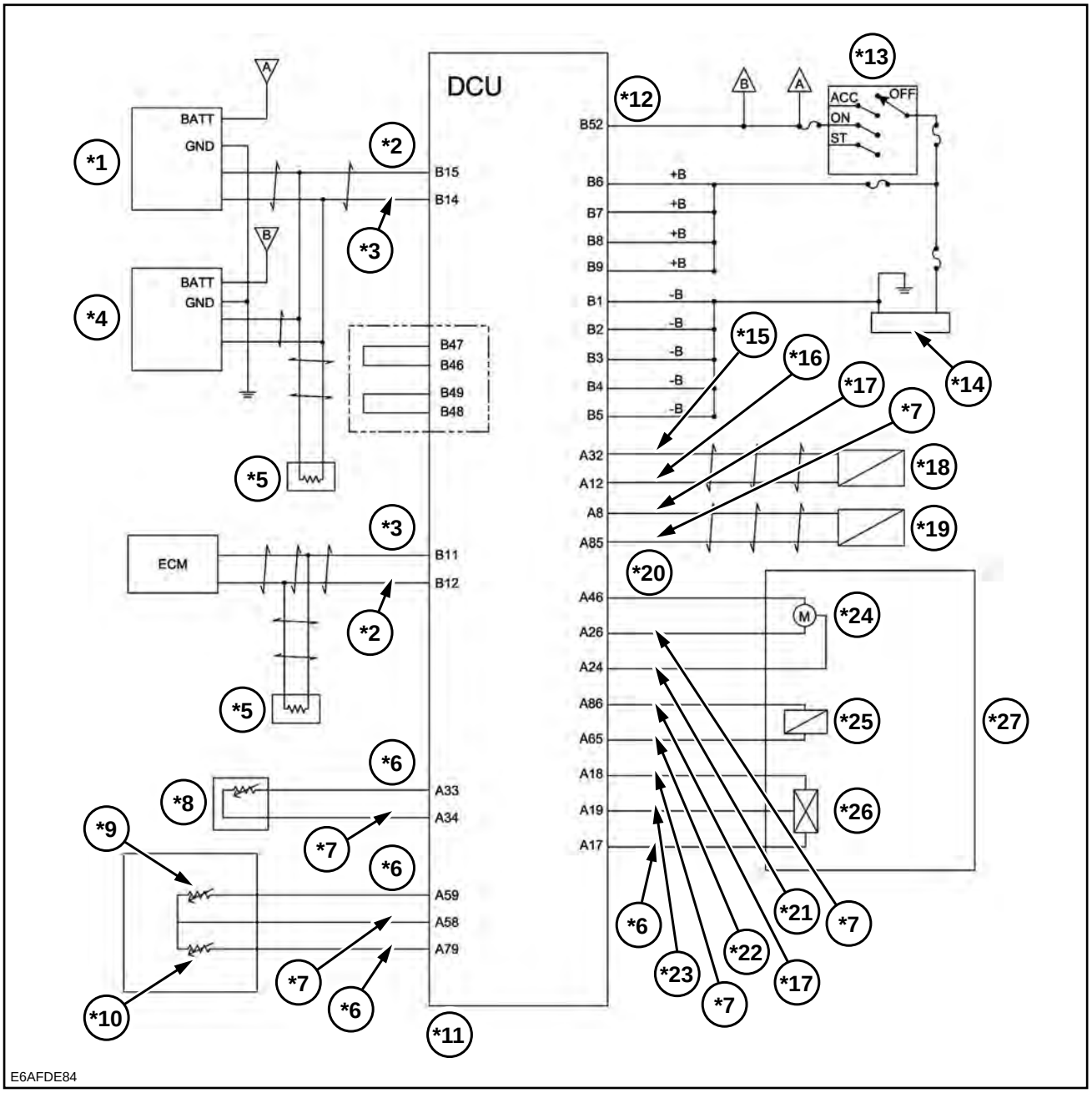
Urea fluid supply module




| | | | | | |
|---|---|---|---|---|---|
| 1 | Supply module bracket | 7 | Supply module filter (Internal) | 13 | Urea fluid pump motor power supply |
| 2 | Coolant inlet connector | 8 | Air hole | 14 | Urea fluid pump motor PWM |
| 3 | Coolant outlet connector | 9 | Urea fluid pressure sensor power supply | 15 | Reverting valve power supply |
| 4 | Urea fluid backflow connector | 10 | Urea fluid pressure sensor signal | 16 | Reverting valve signal |
| 5 | Urea fluid outlet connector | 11 | Urea fluid pressure sensor GND | | |
| 6 | Urea fluid inlet connector | 12 | Urea fluid pump motor GND | | |

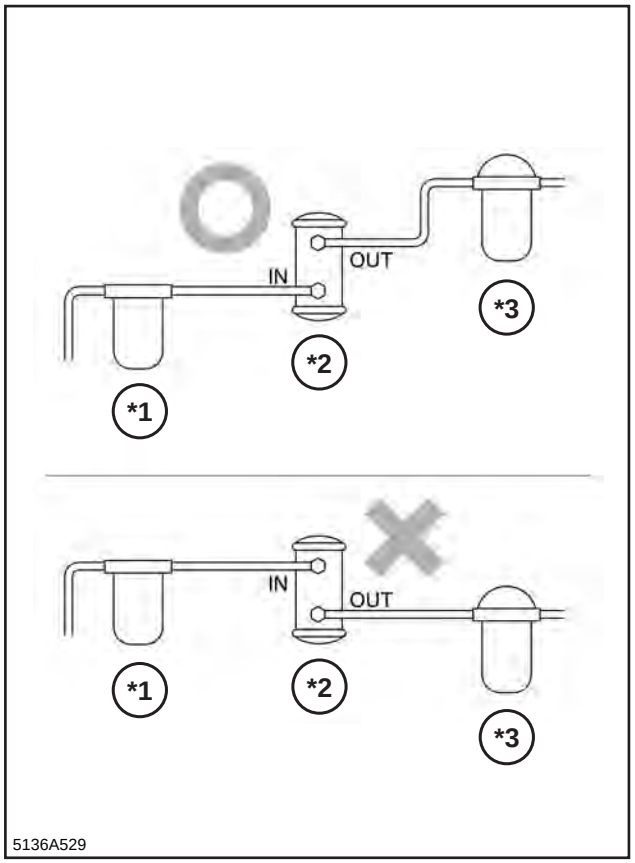
Dosing module

The dosing module is installed at the inlet of the SCR catalyst. It injects urea fluid pressurized by the supply module from the injector into the exhaust pipe according to signals from the DCU. To cool the injector, the engine coolant is circulated in the dosing module.




| | | | | | |
|---|---|---|---|---|---|
| *1 | NOx sensor | *10 | DEF (Urea fluid) tank temperature sensor | *19 | DEF (Urea fluid) tank heater contorol valve |
| *2 | CAN-Low | *11 | A: 86 pin, B: 53 pin | *20 | Motor supply |
| *3 | CAN-High | *12 | IG-SW | *21 | Motor control |
| *4 | DEF (Urea fluid) sensor | *13 | Ignition switch | *22 | Valve control |
| *5 | Resistor | *14 | Battery | *23 | Sensor supply |
| *6 | Signal | *15 | Valve High | *24 | DEF (Urea fluid) pump |
| *7 | GND | *16 | Valve Low | *25 | DEF (Urea fluid) reverting valve |
| *8 | Exhaust gas temperature (EGT) sensor 3 | *17 | Valve supply | *26 | DEF (Urea fluid) pump pressure sensor |
| *9 | DEF (Urea fluid) tank level sensor | *18 | DEF (Urea fluid) injector | *27 | DEF (Urea fluid) supply module |

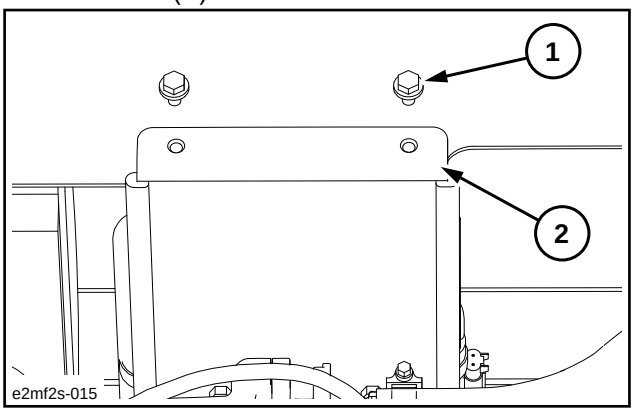
Check for correct wiring connections, tightness, and disconnections, and then check whether the power supply for commercially-available accessories is being diverged from the ECM power supply.
Check whether the ECM ground is dirty and check that it is securely installed in the correct location.
Check that pipes and hoses for fuel, air, and oil are not broken or twisted and that they are correctly connected. Thoroughly check for any leaking or clogging.
Check for fuel leaks and damage and denting on pipes in the fuel system.
Check whether the layout of the fuel filter, pre-filter and charge fuel pump makes it easy for air pockets to form.
Isuzu genuine pre-filter does not have an air-bleed plug. Check that parts are arranged so as to prevent the formation of air pockets.
Also, check that the layout of the charge fuel pump suction and discharge ports is appropriate. Correct layouts where the suction port of the charge fuel pump is on the upper side or the discharge port faces in the moving direction of the actual machine.
Check for fuel leaks and damage and denting on pipes in the fuel system.
Suction air system parts abnormality
Exhaust system parts abnormality



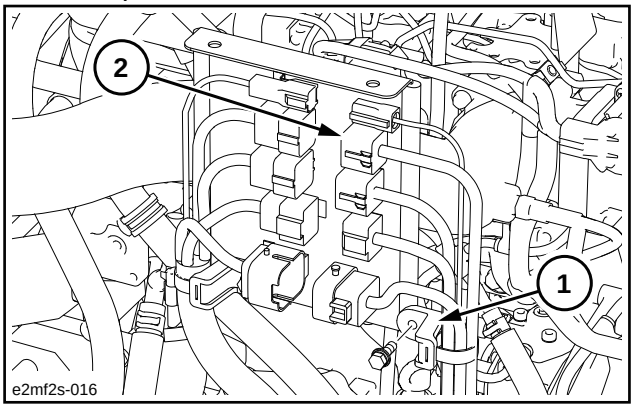

| | |
|---|---|
| *1 | Pre-filter |
| *2 | Power supply pump |
| *3 | Fuel filter |

- Diagnostic aid
  Fuel cut-off, fuel freezing, air entering fuel line, filter abnormality, line abnormality, fuel quality, fuel tank and other fuel system abnormalities
  Filter clogging, suction air line abnormality and other suction air system abnormalities
  Supply pump abnormality, no fuel pressure feed
  Switch input circuit system abnormality
  Throttle position sensor, harness, coolant temperature sensor, and other sensor input circuit system abnormalities
  Throttle position sensor system abnormality
  Engine abnormality caused by seizing, compression pressure deficiency and other mechanical troubles
  Troubles related to the hydraulic pump and other device on the machine
  Effect of wireless devices, lights, or other electrical components installed after purchase

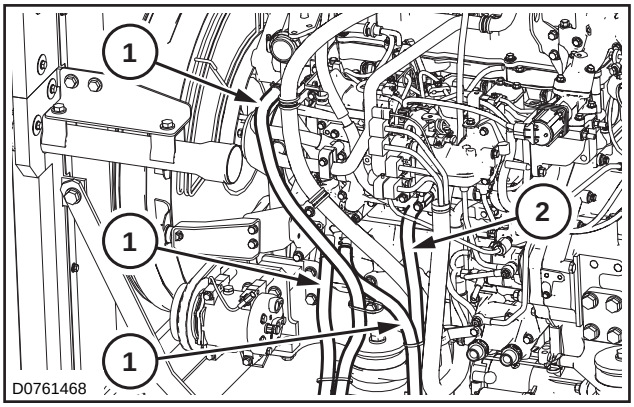
16. Remove the 2 bolts (1) with a wrench [13 mm (0.512 in.)] to remove the connector bracket (2).



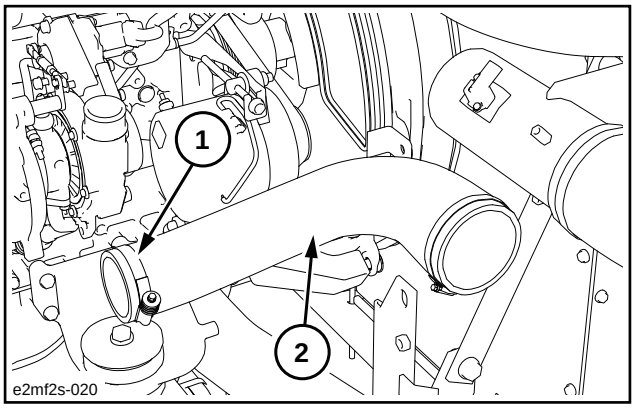

17. Remove the hose band (1) from the bracket with a wrench [13 mm (0.512 in.)] to disconnect the connector (2).
    - Wrap the disconnected connectors with a plastic sheet after bundle them.



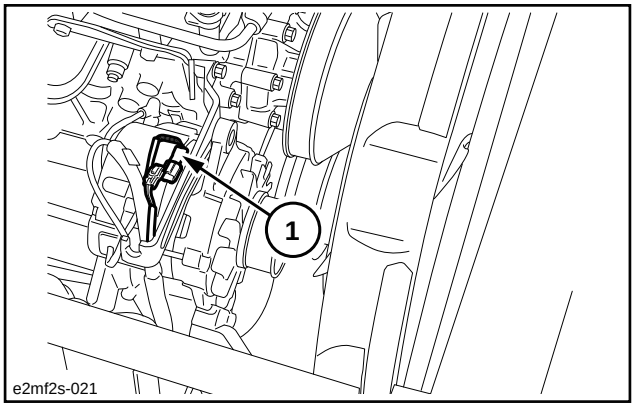

18. Loosen the hose band to disconnect the 3 heater hoses (1).
    Loosen the hose band to disconnect the fuel hose (2).
    - Attach caps and plugs at the engine and the hoses so as to prevent invasion of water, dust and dirt.



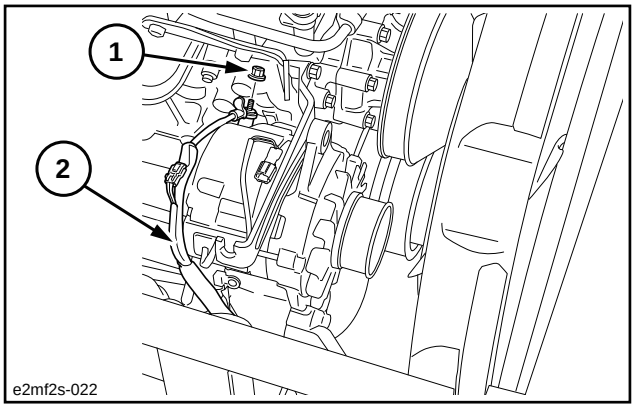

19. Loosen the hose band (1) with a wrench [9.5 mm (0.3740 in.)] to remove the air hose (2).
    - Attach caps at the piping and the hose so as to prevent invasion of water, dust and dirt.




20. Remove the connector (1) of the alternator.



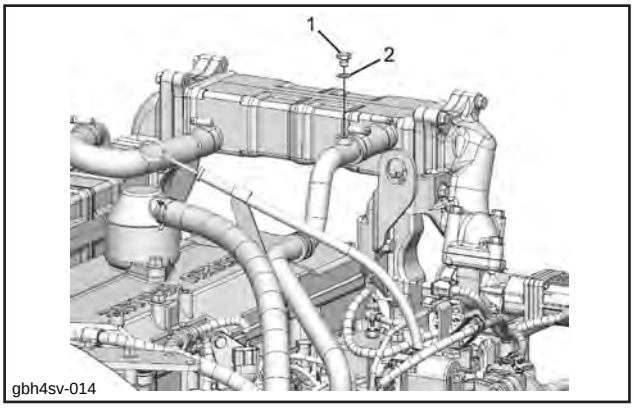

21. Remove the nut (1) with a wrench [10 mm (0.394 in.)] to remove the wiring (2) of the alternator.



[1] Remove the air bleeding plug from the EGR cooler.

Note

- If the EGR cooler has an air bleeding plug, loosen the plug.
- With the pressurized reserve tank specification, it is not necessary to bleed the air.




| | |
|---|---|
| 1 | Air bleeding plug |
| 2 | Gasket |

[2] Replenish the radiator with coolant.

Caution

- Add slowly to prevent air from entering the system.

[3] Install the air bleeding plug to the EGR cooler.

Note

- Check that the coolant has overflowed.
- With the pressurized reserve tank specification, it is not necessary to bleed the air.

Caution

- Do not reuse the gasket.

tightening torque： 27 N・m { 2.8 kgf・m / 20 lb・ft. }

[4] Replenish the radiator with coolant.

Note

- While manually pressing the upper hose several times to bleed air in the hose, add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.
- Repeat until the coolant level no longer decreases.

[5] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[6] Add coolant to the radiator reserve tank.

Note

- Add up to the MAX line of the radiator reserve tank.
- Perform the urea SCR dosing module coolant piping air bleeding process while referring to the owner's manual from the machinery manufacturer.

Caution

- Wipe off any excess coolant.

[7] Start the engine.

Note

- Idle the engine for 5 minutes.

[8] Stop the engine.

[9] Remove the radiator cap from the radiator.

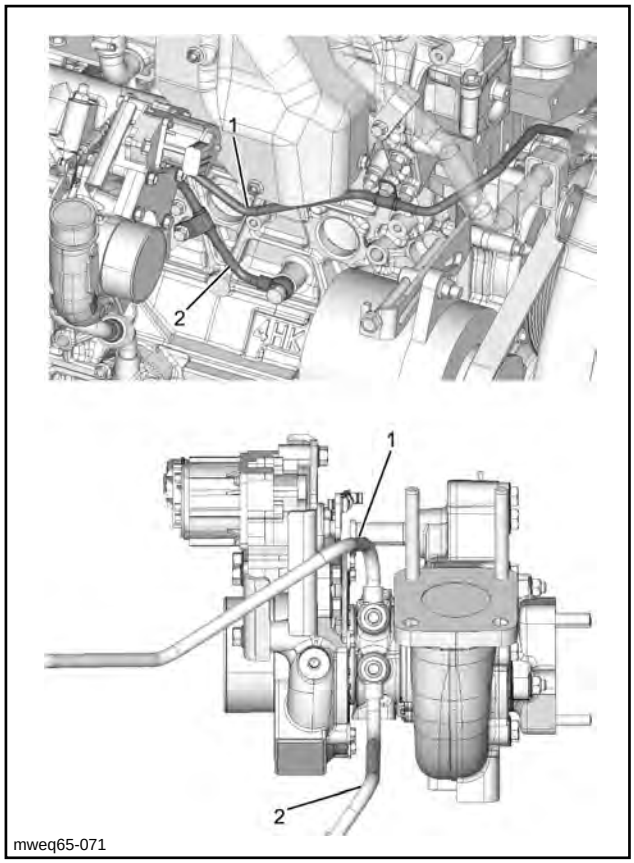
Caution

- Do not loosen the radiator cap or sub-tank cap when the coolant temperature is high.
- Because steam and boiling water can burst out from the radiator and possibly cause burns, check that the engine has cooled.

[10] Replenish the radiator with coolant.

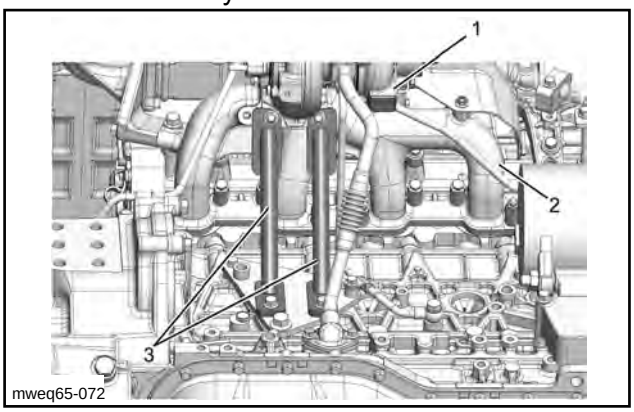
Note

- Add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.




| | |
|---|---|
| 1 | Water return pipe |
| 2 | Water feed pipe |

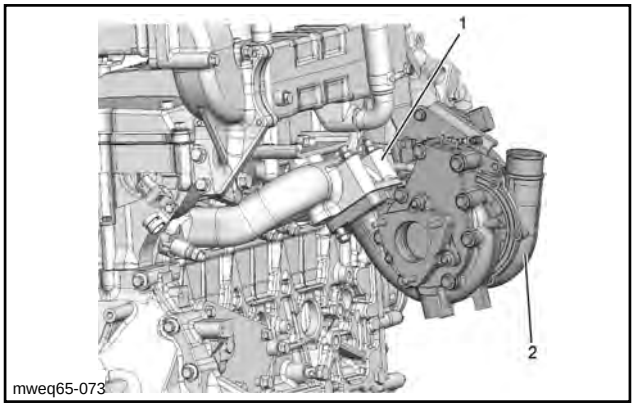
[12] Remove the exhaust manifold stay from the cylinder block and the turbocharger assembly.




| | |
|---|---|
| 1 | Turbocharger assembly |
| 2 | Exhaust manifold |
| 3 | Exhaust manifold stay |

[13] Disengage the harness connector from the turbocharger assembly.

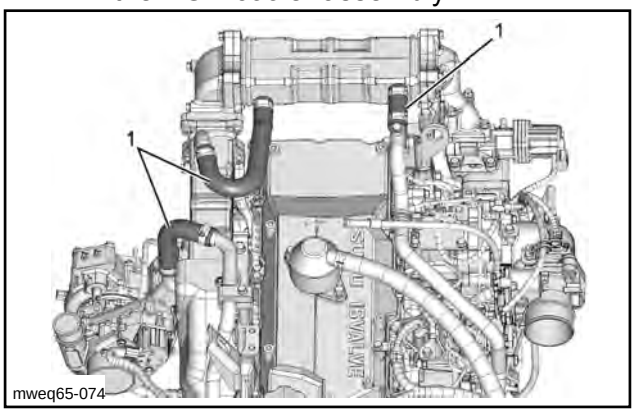
[14] Remove the turbocharger assembly from the exhaust manifold.




| | |
|---|---|
| 1 | Exhaust manifold |
| 2 | Turbocharger assembly |

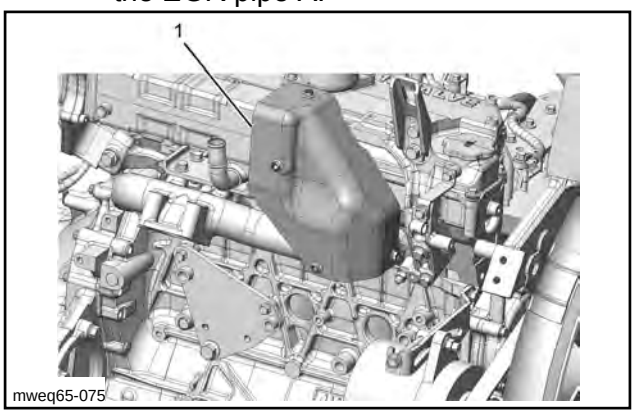
5. Box-shaped EGR cooler assembly removal

[1] Disconnect the water rubber hose from the EGR cooler assembly.

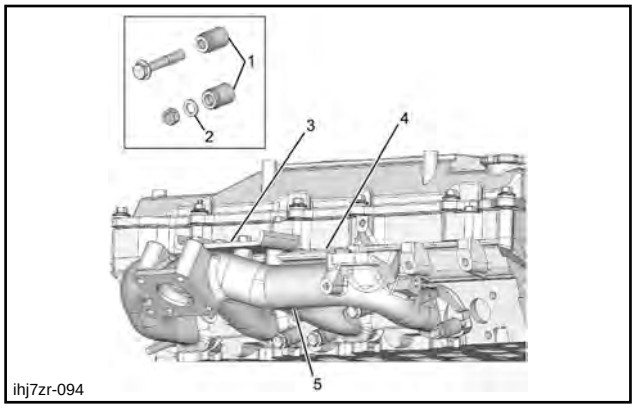



| | |
|---|---|
| 1 | Water rubber hose |

[2] Remove the EGR heat protector from the EGR pipe A.




| | |
|---|---|
| 1 | EGR heat protector |



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| | |
|---|---|
| 1 | Distance tube |
| 2 | Washer |
| 3 | Exhaust manifold bracket |
| 4 | Exhaust manifold bracket |
| 5 | Exhaust manifold |

16. Inlet cover installation

[1] Apply the liquid gasket to the inlet cover.

Note

・Align with the inlet cover groove and apply ThreeBond 1207.

bead width： 3 - 6 mm { 0.098 - 0.217 in. }

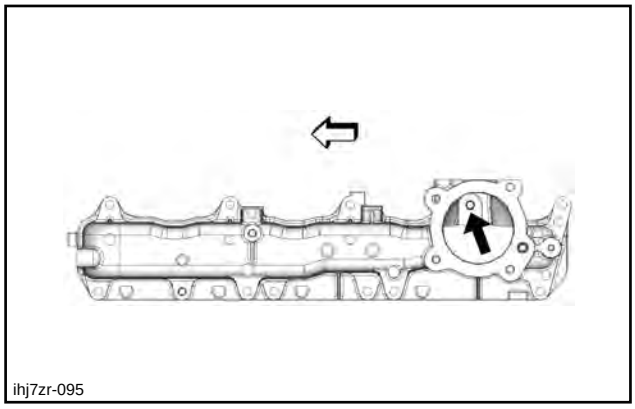
Caution

・After applying liquid gasket, install the inlet cover within 5 minutes.

[2] Temporarily tighten the inlet cover to the cylinder head assembly.

Caution

・Do not forget to install the bolts indicated by the arrow in the diagram.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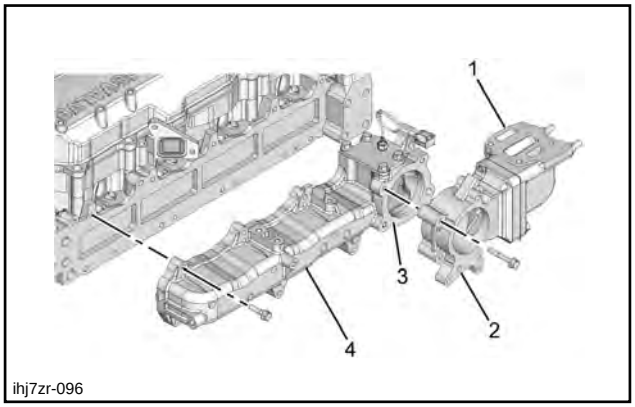
Caution

・Completely tighten the installation bolt and nut when installing the common rail assembly.

[3] Install the case to the inlet cover.
tightening torque： 22 N・m { 2.2 kgf・m / 16 lb・ft. }

Note

・Install it together with the EGR pipe D.



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| | |
|---|---|
| 1 | EGR pipe D |
| 2 | Case |
| 3 | Gasket |
| 4 | Inlet cover |

17. Engine hanger bracket installation

[1] Install the front engine hanger bracket to the cylinder head assembly.
tightening torque： 104 N・m { 10.6 kgf・m / 77 lb・ft. } Front engine hanger bracket
tightening torque： 48 N・m { 4.9 kgf・m / 35 lb・ft. } Front engine hanger

[2] Install the rear engine hanger bracket to the cylinder head assembly.
tightening torque： 104 N・m { 10.6 kgf・m / 77 lb・ft. } Rear engine hanger bracket
tightening torque： 48 N・m { 4.9 kgf・m / 35 lb・ft. } Rear engine hanger

Caution

・Do not change the engine speed when the engine is started.
・If the engine does not start, repeat the process from step 2 again.

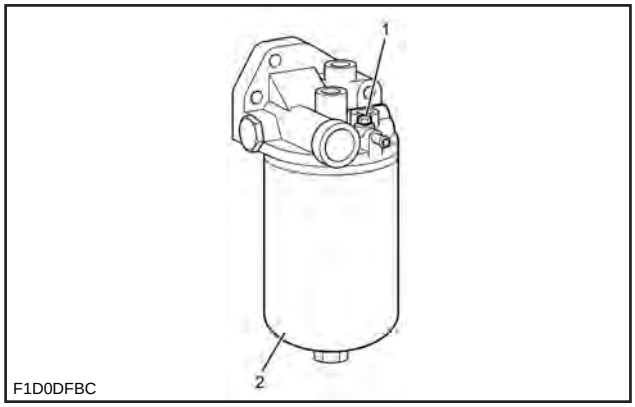
Note

・Slowly increase the engine speed, and maintain it for 3 minutes.
・Accelerate the engine speed to maximum.

[10] Stop the engine.

Note

・The following applies to the cartridge-type specification.




| | |
|---|---|
| 1 | Air bleeding plug |
| 2 | Cartridge-type element |

[11] Prepare a pan.

[12] Turn ON the ignition switch.

[13] Loosen the air bleeding plug using a wrench.

Note

・Check that fuel comes out from around the plug.

[14] Tighten the air bleeding plug using a wrench.
tightening torque： 10 N・m { 1.0 kgf・m / 7 lbf・ft. }

Caution

・Fully remove any fuel in the area after tightening the plug.

[15] Start the engine.

Note

・Idle the engine for 5 seconds.

Caution

・Do not change the engine speed when the engine is started.
・If the engine does not start, repeat the process from step 12.

Note

・Slowly increase the engine speed, and maintain it for 3 minutes.
・Increase the engine speed to the maximum speed.

[16] Stop the engine.

Inspection

1. Bridge cap Inspection

[1] Measure the bridge cap using the dial gauge.

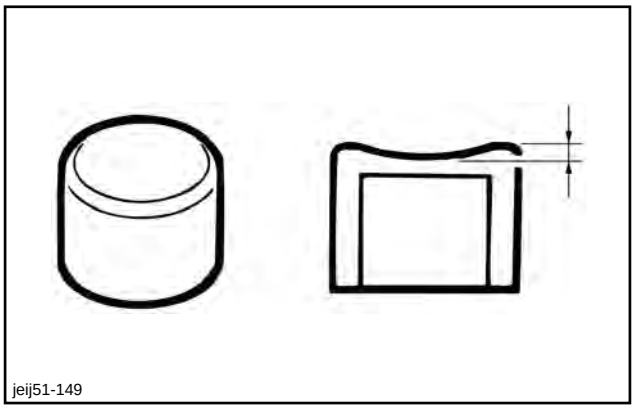
Note

・Measure the contact surface of the bridge cap and rocker arm.

Limit: 0.1 mm {0.0039 in.} Amount of wear on the bridge cap

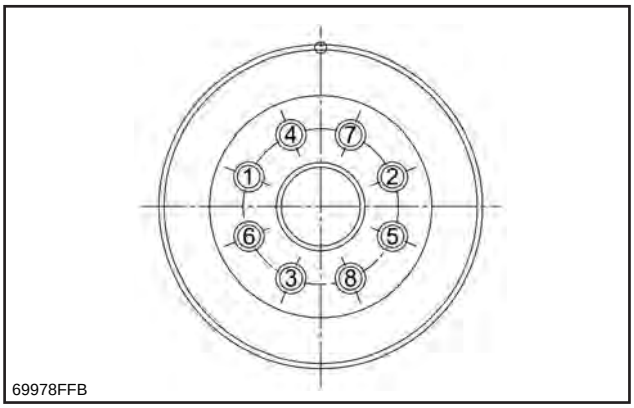
Caution

・Replace the bridge cap if the measured value exceeds the limit value.
・Replace the bridge cap if it has an abnormal wear such as band-shaped wear.



36. Flywheel removal
[1] Remove the flywheel from the crankshaft.

Note
・Gradually loosen the flywheel installation bolts in the order shown in the diagram.



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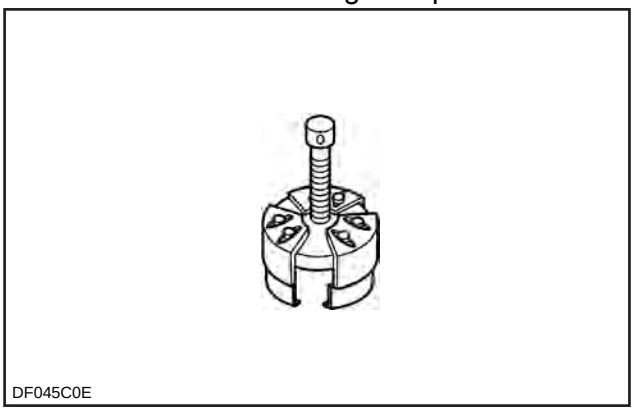
Caution
・Fix the flywheel firmly so that it will not rotate.

37. Crankshaft rear oil seal removal
[1] Remove the crankshaft rear oil seal from the crankshaft using the special tool.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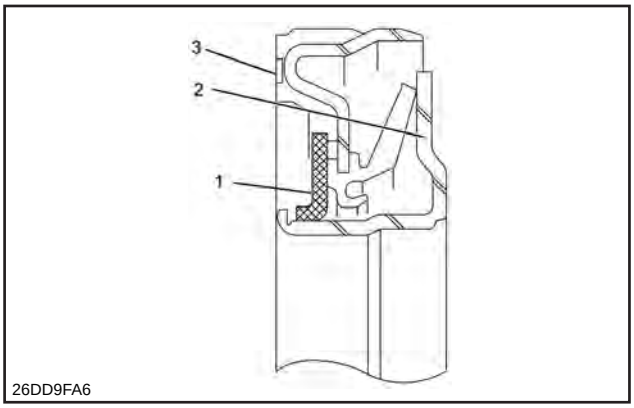
SST: 5-8840-2360-0 - rear oil seal remover



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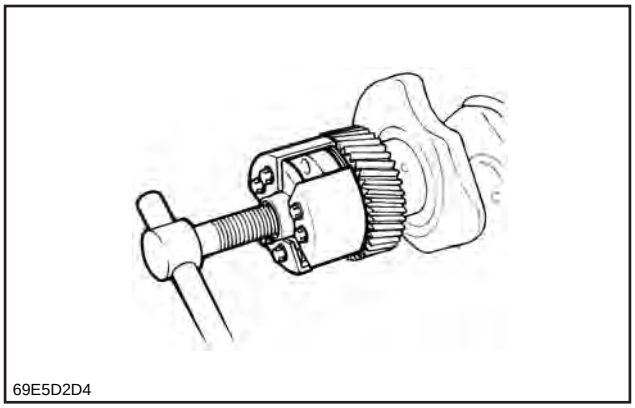
| | |
|---|---|
| 1 | Felt |
| 2 | Slinger |
| 3 | Crankshaft rear oil seal |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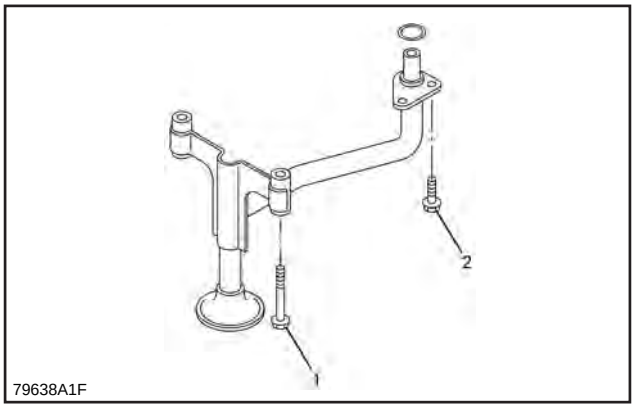
Caution
・Be careful not to damage the oil seal pressfitting surface.

Note
・Remove the slinger and oil seal together.
・・f the slinger of the remover is easy to come off, the outer circumference of the jig can be tightened using a clip band to improve the workability.

38. Oil pan removal
[1] Disconnect the harness connector from the oil level switch.
[2] Remove the oil pan from the crankcase.
[3] Remove the gasket from the oil pan.

39. Oil strainer removal
[1] Remove the oil strainer from the crankcase.
[2] Remove the O-ring from the oil strainer.

Caution
・Do not reuse the O-ring.



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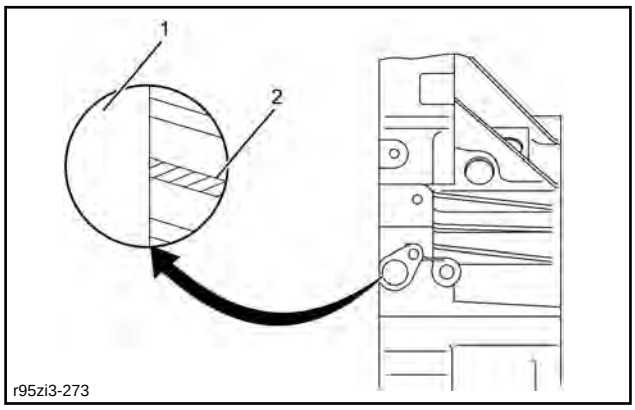
| | |
|---|---|
| 1 | M10 bolt |
| 2 | M8 bolt |

40. Flywheel housing removal
[1] Remove the cover from the flywheel housing.

[7] Check alignment mark of the supply pump gear.

Note

・・Confirm that the alignment mark can be seen through the plug hole on the left side of the flywheel housing.




| | |
|---|---|
| 1 | Plug hole |
| 2 | Alignment mark |

Caution

・If the alignment mark could not be confirmed, adjust the position of the supply pump gear.

[8] Securely tighten the fuel supply pump to the cylinder block.
tightening torque： 50 N・m { 5.1 kgf・m / 37 lb・ft. } Nut
tightening torque： 76 N・m { 7.7 kgf・m / 56 lb・ft. } Bolt

[9] Connect the harness connector to the fuel supply pump.

18. Front cover installation

[1] Clean the cylinder block using the scraper.

[2] Apply the liquid gasket to the front cover.

Note

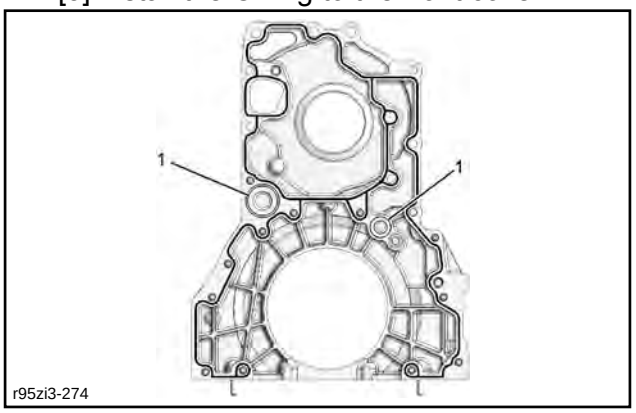
・Use ThreeBond 1207B.

bead width： 1.5 - 5.0 mm { 0.0591 - 0.1969 in. }
bead height： 0.3 - 1.5 mm { 0.0118 - 0.0591 in. }

Caution

・After applying the liquid gasket, install the front cover within 5 minutes.

[3] Install the O-ring to the front cover.




| | |
|---|---|
| 1 | O-ring |

[4] Install the front cover to the cylinder block.

Caution

・Pay attention to the knock pin position of the cylinder block.

tightening torque： 24 N・m { 2.4 kgf・m / 17 lb・ft. }

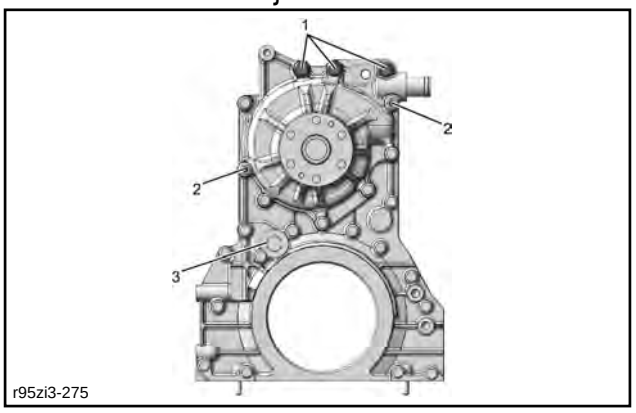
19. Water pump assembly installation

[1] Install the water pump assembly to the front cover.

Caution

・Use new gaskets.

tightening torque： 52 N・m { 5.3 kgf・m / 38 lb・ft. } 1 bolt in the diagram
tightening torque： 24 N・m { 2.4 kgf・m / 17 lb・ft. }

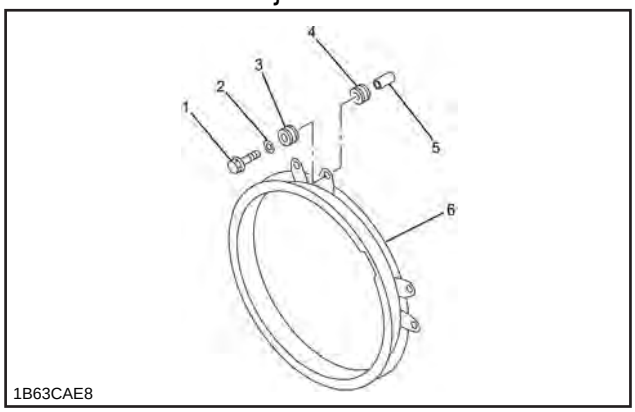



| | |
|---|---|
| 1 | Bolt |
| 2 | Stud bolt |
| 3 | Oil relief valve |

[2] Connect the water hose to the water pump assembly.

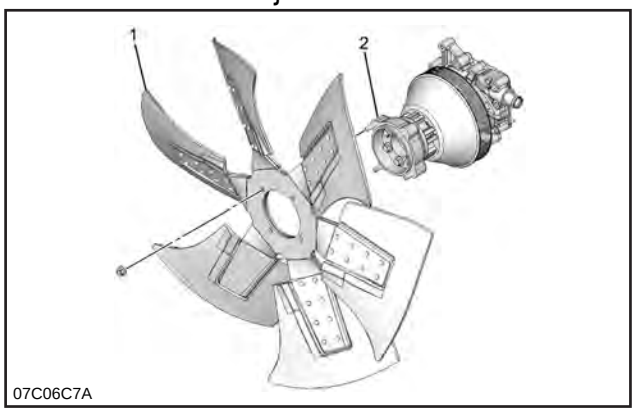
[3] Connect the water return pipe to the water pump assembly.
tightening torque： 35 N・m { 3.6 kgf・m / 26 lb・ft. }

46. Fan guide installation
[1] Install the fan guide bracket to the engine assembly.
tightening torque : 40 N・m { 4.1 kgf・m / 30 lb・ft. }
[2] Install the fan guide to the fan guide bracket.
tightening torque : 30 N・m { 3.1 kgf・m / 22 lb・ft. }




| | |
|---|---|
| 1 | Bolt |
| 2 | Washer |
| 3 | Rubber mount |
| 4 | Rubber mount |
| 5 | Guide tube |
| 6 | Fan guide |

47. Cooling fan installation
[1] Install the cooling fan to the adapter.
tightening torque : 52 N・m { 5.3 kgf・m / 38 lb・ft. }




| | |
|---|---|
| 1 | Cooling fan |
| 2 | Adapter |

48. Engine harness connect
[1] Connect the engine harness to the engine assembly.

Note
・Connect each connector.

49. Engine oil filling
[1] Replenish the engine oil with the engine assembly.

Note
・Add engine oil up to the MAX position of the oil level gauge.

Caution
・Confirm the tightening of the oil pan drain before adding engine oil.

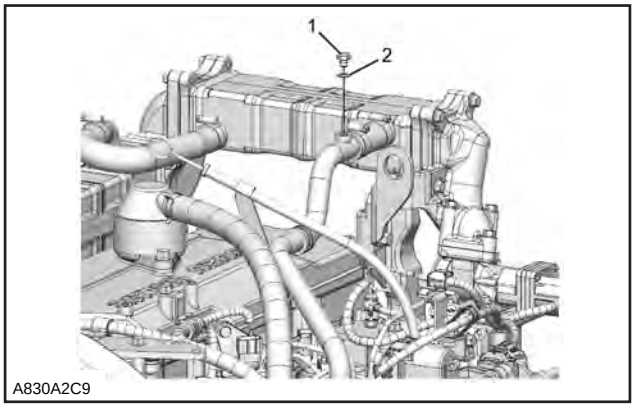
50. Battery ground cable connect
[1] Connect the battery ground cable to the battery.

51. Coolant filling

Caution
・Work while taking care to prevent excess coolant from splashing onto the exhaust system parts.
・Wipe off any excess coolant.

[1] Remove the air bleeding plug from the EGR cooler.

Note
・If the EGR cooler has an air bleeding plug, loosen the plug.
・With the pressurized reserve tank specification, it is not necessary to bleed the air.




| | |
|---|---|
| 1 | Air bleeding plug |
| 2 | Gasket |

[2] Replenish the radiator with coolant.

Caution
・Add slowly to prevent air from entering the system.

| | |
|---|---|
| 1 | Bolt |

33. Idle gear measurement

[1] Align the dial gauge to the idle gear.

Note

・Attach the dial gauge to the idle gear tooth to be measured.

[2] Inspect the backlash.

Note

・Gently move the gear right and left to read the inconsistency on the dial gauge.

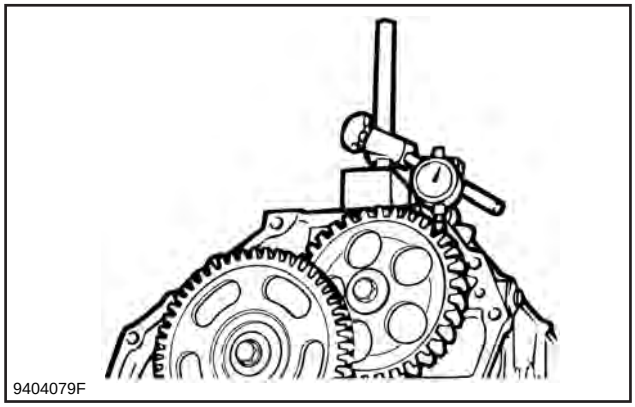
Caution

・Measure the idle gear backlash before removing the idle gear A.

specified value： 0.10 - 0.17 mm
{ 0.0039 - 0.0067 in. }
limit： 0.30 mm { 0.0118 in. }

Caution

・Replace the idle gear if the measured value exceeds the limit value.




[3] Measure the clearance using the feeler gauge.

Note

・Measure the clearance between the idle gear and the thrust collar.

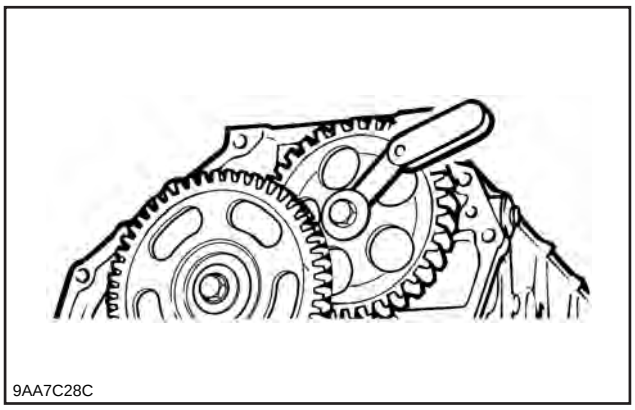
Caution

・Measure the play of the idle gear in the axis direction before removing the idle gear B.

specified value： 0.080 - 0.155 mm
{ 0.0031 - 0.0061 in. }
limit： 0.20 mm { 0.0079 in. }

Caution

・Replace the idle gear if the measured value exceeds the limit value.

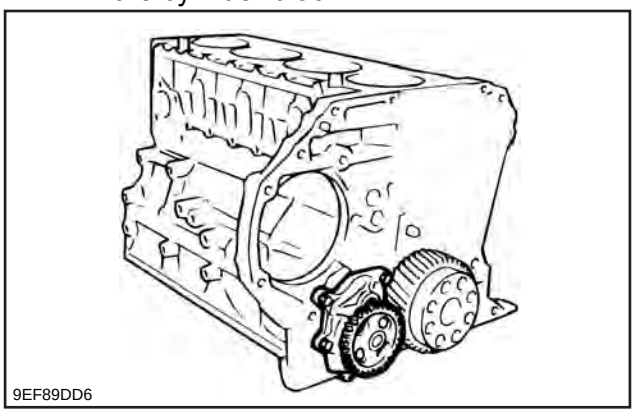



34. Idle gear A removal

[1] Remove the idle gear A from the idle gear A shaft.

35. Oil pump assembly removal

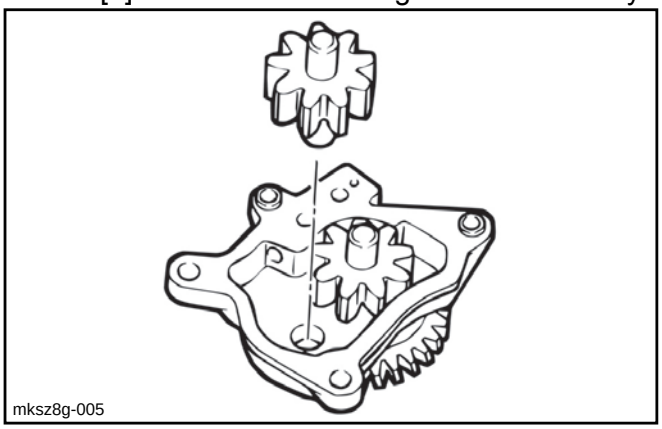
[1] Remove the oil pump assembly from the cylinder block.




Disassembly of Oil Pump Assembly

1. Oil pump assembly Disassembly

[1] Remove the driven gear from the body.

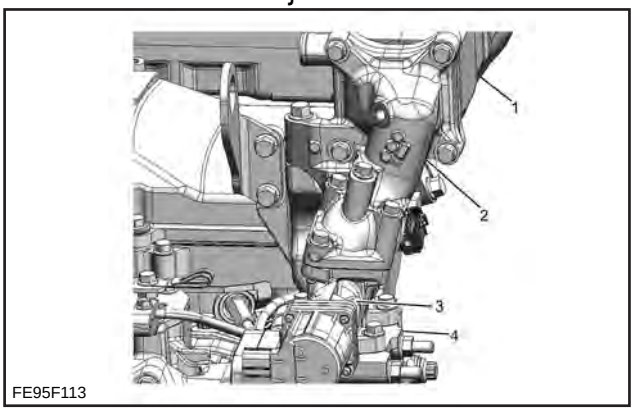



[2] Remove the cotter pin from the body.

[3] Remove the spring from the body.

27. EGR valve installation

[1] Install the EGR valve to the EGR pipe D.
tightening torque : 24 N・m { 2.4 kgf・m / 17 lb・ft. }




| | |
|---|---|
| 1 | EGR cooler C |
| 2 | EGR pipe C |
| 3 | EGR valve |
| 4 | EGR pipe D |

**Caution**

・Use new gaskets.

[2] Connect the harness connector to the EGR valve.

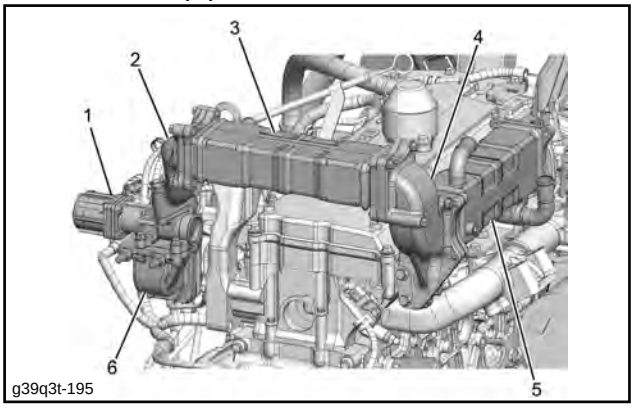
28. EGR cooler assembly installation

[1] Temporarily tighten EGR pipe C to the EGR valve.

[2] Temporarily tighten EGR cooler B to EGR pipe C.

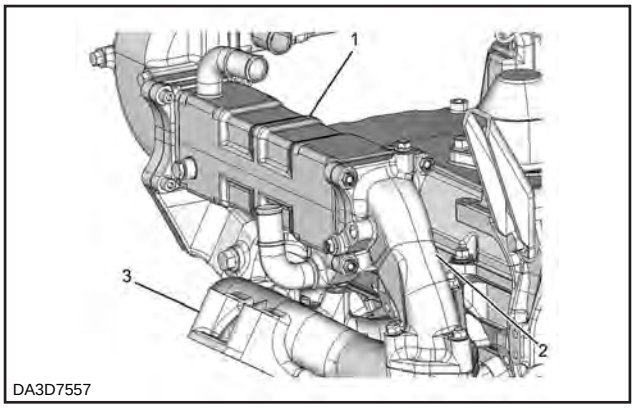
[3] Temporarily tighten EGR pipe B to EGR cooler B.

[4] Temporarily tighten EGR cooler A to EGR pipe B.




| | |
|---|---|
| 1 | EGR valve |
| 2 | EGR pipe C |
| 3 | EGR cooler B |
| 4 | EGR pipe B |
| 5 | EGR cooler A |
| 6 | EGR pipe D |

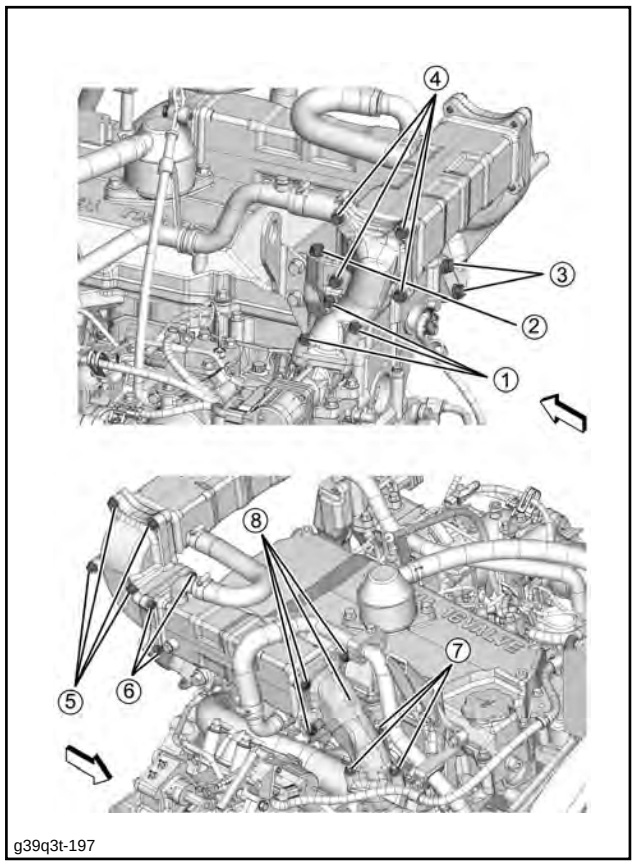
[5] Temporarily tighten EGR pipe A to EGR cooler A and the exhaust manifold.




| | |
|---|---|
| 1 | EGR cooler A |
| 2 | EGR pipe A |
| 3 | Exhaust manifold |

**Note**

・After temporarily tightening all the components, final tighten in the numerical order shown in the diagram.




[6] Final tighten EGR pipe C to the EGR valve.
tightening torque : 24 N・m { 2.4 kgf・m / 18 lb・ft. } Diagram No. 1

[7] Final tighten EGR pipe C to the engine hanger bracket.

[4] Replenish the radiator with coolant.

Note

- While manually pressing the upper hose several times to bleed air in the hose, add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.
- Repeat until the coolant level no longer decreases.

[5] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[6] Add coolant to the radiator reserve tank.

Note

- Add up to the MAX line of the radiator reserve tank.
- Perform the urea SCR dosing module coolant piping air bleeding process while referring to the owner's manual from the machinery manufacturer.

Caution

- Wipe off any excess coolant.

[7] Start the engine.

Note

- Idle the engine for 5 minutes.

[8] Stop the engine.

[9] Remove the radiator cap from the radiator.

Caution

- Do not loosen the radiator cap or sub-tank cap when the coolant temperature is high.
- Because steam and boiling water can burst out from the radiator and possibly cause burns, check that the engine has cooled.

[10] Replenish the radiator with coolant.

Note

- Add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.

Caution

- If the coolant amount is excessively low, inspect for coolant leakage.

[11] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[12] Start the engine.

Note

- For models with heaters, the set temperature and blower speed are set to the maximum, and warm up the engine at approximately 1500 - 2000 r/min.
- Touch the radiator upper hose, and confirm that it has become warm.

Caution

- If the upper hose is not warm, perform step 12 again.

Note

- Idle the engine for 5 minutes.

[13] Stop the engine.

[14] Remove the radiator cap from the radiator.

Caution

- Confirm that the engine has cooled.

[15] Replenish the radiator with coolant.

Note

- Add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.

Caution

- If the coolant amount is excessively low, inspect for coolant leakage.

[16] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[4] Replenish the radiator with coolant.

Note

- While manually pressing the upper hose several times to bleed air in the hose, add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.
- Repeat until the coolant level no longer decreases.

[5] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[6] Add coolant to the radiator reserve tank.

Note

- Add up to the MAX line of the radiator reserve tank.
- Perform the urea SCR dosing module coolant piping air bleeding process while referring to the owner's manual from the machinery manufacturer.

Caution

- Wipe off any excess coolant.

[7]

a. Start the engine.

b. In order to bleed the urea SCR dosing module coolant piping of air, choose the CCV (coolant control valve) operation test in the device test from the service support screen.

Note

- Repeat the operation test several times.
- Idle the engine for 5 minutes.

[8] Stop the engine.

[9] Remove the radiator cap from the radiator.

Caution

- Do not loosen the radiator cap or sub-tank cap when the coolant temperature is high.
- Because steam and boiling water can burst out from the radiator and possibly cause burns, check that the engine has cooled.

[10] Replenish the radiator with coolant.

Note

- Add an amount of coolant equal to the difference between the remaining coolant level and the radiator cap mouth.

Caution

- If the coolant amount is excessively low, inspect for coolant leakage.

[11] Install the radiator cap to the radiator.

Caution

- Securely attach the radiator cap.

[12]

a. Start the engine.

b. In order to bleed the urea SCR dosing module coolant piping of air, choose the CCV (coolant control valve) operation test in the device test from the service support screen.

Note

- Repeat the operation test several times.
- For models with heaters, the set temperature and blower speed are set to the maximum, and warm up the engine at approximately 1500 - 2000 r/min.
- Touch the radiator upper hose, and confirm that it has become warm.

Caution

- If the upper hose is not warm, perform step 12 again.

Note

- Idle the engine for 5 minutes.

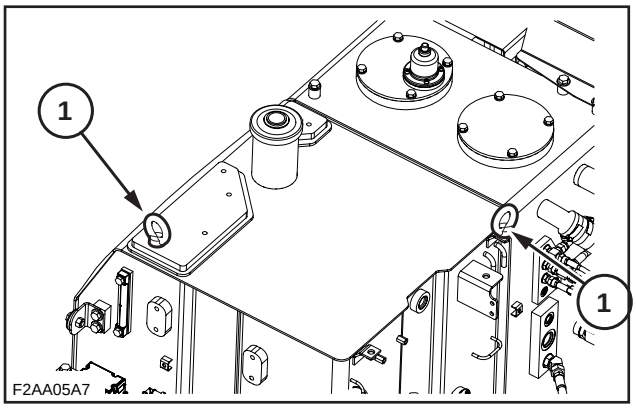
[13] Stop the engine.

[14] Remove the radiator cap from the radiator.

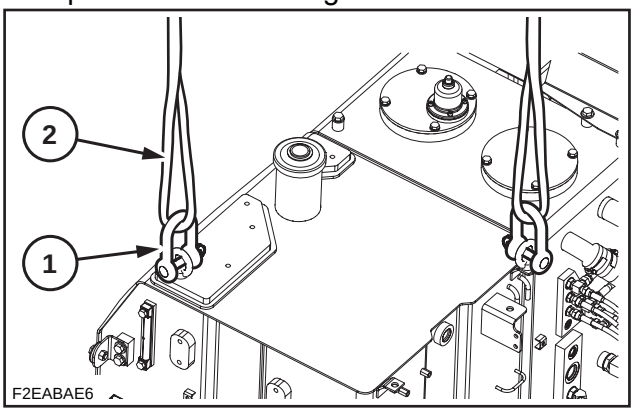
Caution

- Confirm that the engine has cooled.

17. Attach the 2 eyebolts (M12) (1) on top of the fuel tank.
    - Tighten up the eyebolt all the way and then loosen it for a half turn.



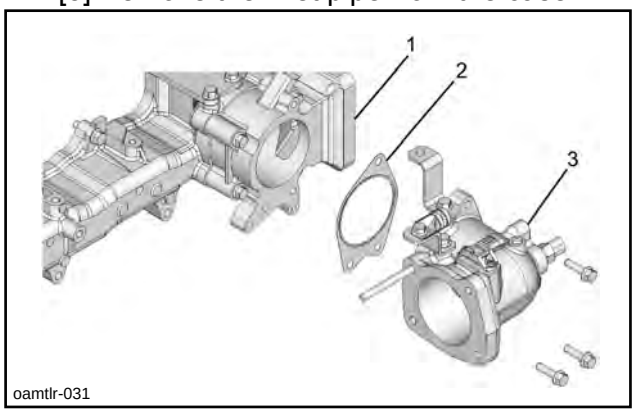

18. Attach the 2 shackles (1) to the eyebolt and then lift it with a wire rope (2) and a liftcrane.
    Make sure that you have a safe site, and then settle the fuel tank on a wood plank or other block.
    Make sure to secure the fuel tank so as to prevent it from falling.




## Installation of fuel tank

To install, perform the reverse of the removal procedure.
When installing the bolts, tighten them to the specified torque.
If the torque is not specified, see the "Standard Torque Data for Cap Screws and Nuts".
Finally, carefully check for any fuel leaks.

[5] Remove the inlet pipe from the case.




| | |
|---|---|
| 1 | Case |
| 2 | Gasket |
| 3 | Inlet pipe |

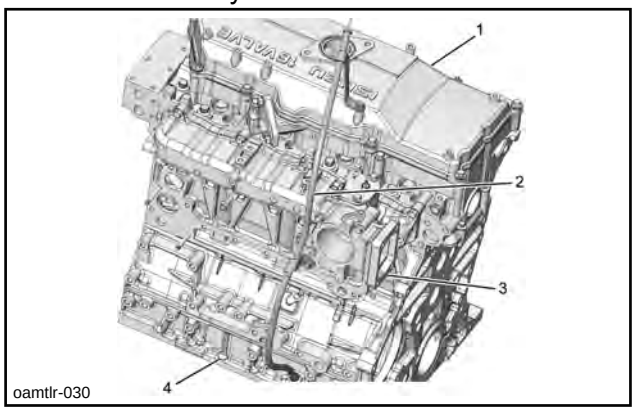
5. Oil level gauge guide tube removal

[1] Remove the oil level gauge from the oil level gauge guide tube.

[2] Disconnect the oil level gauge guide tube from the cylinder head cover.

[3] Disconnect the oil level gauge guide tube from the case.

[4] Remove the oil level gauge guide tube from the cylinder block.




| | |
|---|---|
| 1 | Cylinder head cover |
| 2 | Oil level gauge guide tube |
| 3 | Case |
| 4 | Cylinder block |

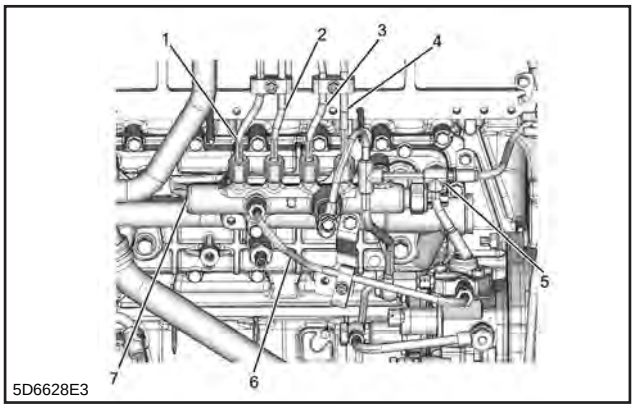
6. Injection pipe removal

[1] Remove the clip from the bracket.

[2] Remove the injection pipe from the injector and the common rail assembly.

**Caution**

- Do not reuse the removed injection pipe.
- Seal the common rail and injector to prevent foreign material from entering.



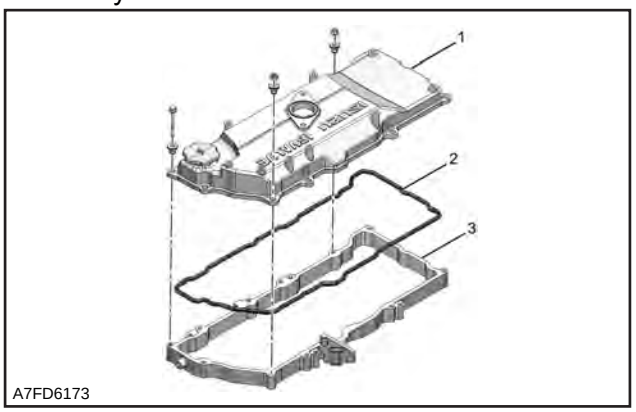

| | |
|---|---|
| 1 | No.1 injection pipe |
| 2 | No.2 injection pipe |
| 3 | No.3 injection pipe |
| 4 | No.4 injection pipe |
| 5 | Fuel leak-off pipe |
| 6 | Fuel pipe |
| 7 | Common rail assembly |

7. Cylinder head cover removal

[1] Disconnect the ventilation hose from the air breather.

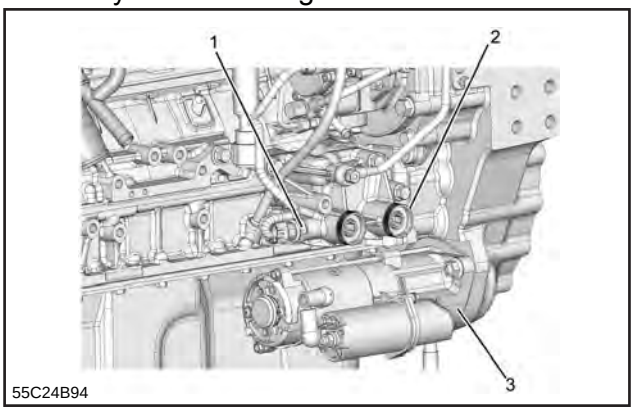
[2] Remove the cylinder head cover from the lower cover.

[3] Remove the head cover gasket from the cylinder head cover.




| | |
|---|---|
| 1 | Cylinder head cover |
| 2 | Gasket |
| 3 | Lower cover |

[2] Remove the starter assembly from the flywheel housing.




| | |
|---|---|
| 1 | Oil pressure sensor |
| 2 | Oil port cover |
| 3 | Starter assembly |

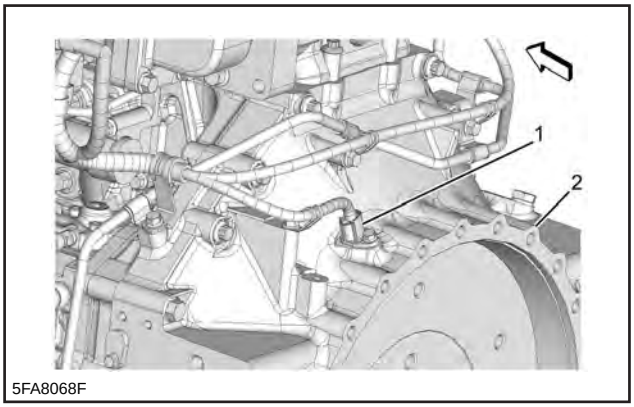
28. CKP sensor removal

[1] Disconnect the harness connector from the CKP sensor.

[2] Remove the CKP sensor from the flywheel housing.

**Caution**

・Be careful not to subject the sensor to shock.



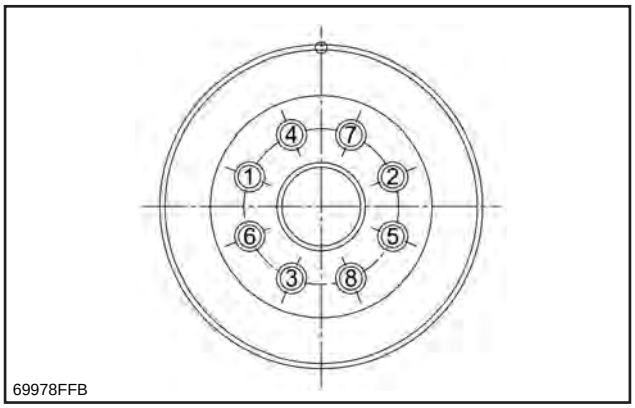

| | |
|---|---|
| 1 | CKP sensor |
| 2 | Flywheel housing |

29. Flywheel removal

[1] Remove the flywheel from the crankshaft.

**Note**

・Gradually loosen the flywheel installation bolts in the order shown in the diagram.

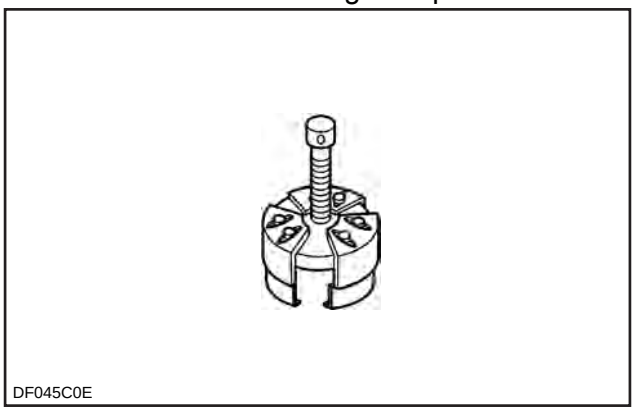



**Caution**

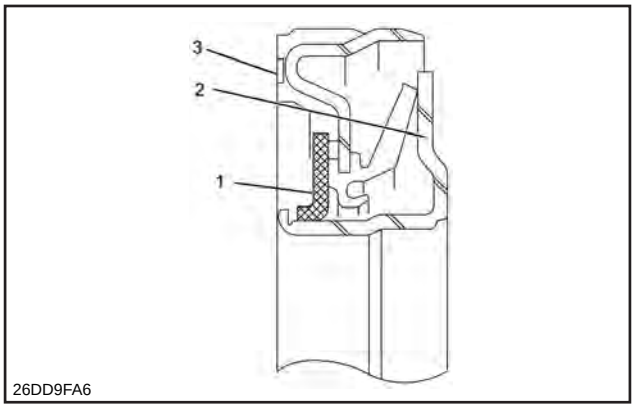
・Fix the flywheel firmly so that it will not rotate.

30. Crankshaft rear oil seal removal

[1] Remove the crankshaft rear oil seal from the crankshaft using the special tool.




SST: 5-8840-2360-0 - rear oil seal remover

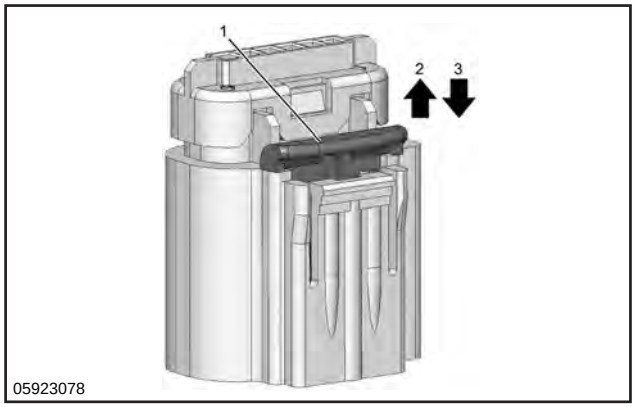



| | |
|---|---|
| 1 | Felt |
| 2 | Slinger |
| 3 | Crankshaft rear oil seal |

[3] Connect the harness connector to the intake throttle valve.

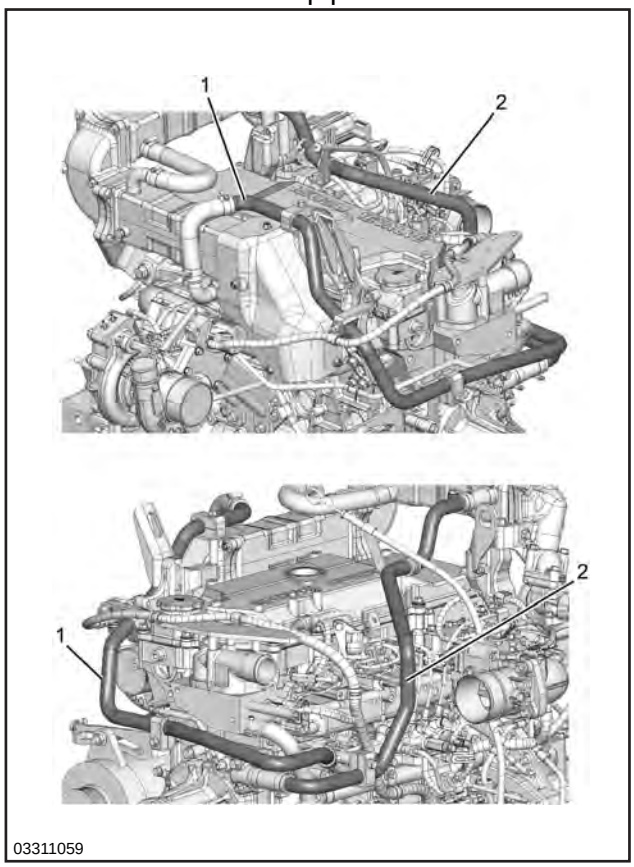
Note

・After connecting the harness connector, press in the lock operation portion to lock.




| | |
|---|---|
| 1 | Lock operation section |
| 2 | Lock release |
| 3 | Lock |

26. EGR cooler water pipe installation




| | |
|---|---|
| 1 | EGR cooler water feed pipe |
| 2 | EGR cooler water return pipe |

[1] Install the EGR cooler water pipe to the engine assembly.

Note

・Install the EGR cooler water feed pipe and EGR cooler water return pipe.

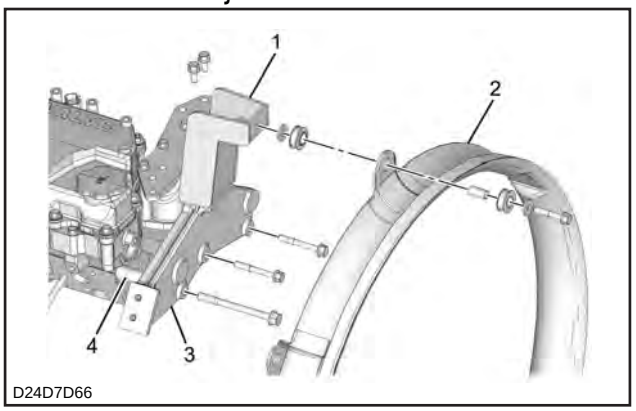
tightening torque: 24 N・m { 2.4 kgf・m / 17 lb・ft. } Clamp

[2] Connect the radiator upper hose to the water outlet pipe.

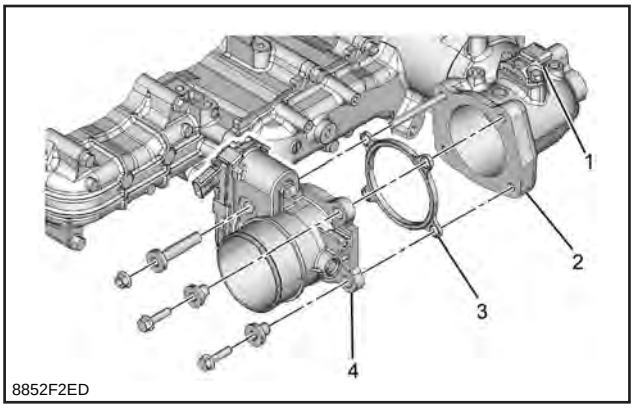
[3] Install the fan guide bracket to the cylinder head assembly.
tightening torque: 50 N・m { 5.1 kgf・m / 37 lb・ft. }
tightening torque: 97 N・m { 9.9 kgf・m } The area where the spacer is used

[4] Install the fan guide stay to the fan guide bracket.
tightening torque: 45 N・m { 4.6 kgf・m / 33 lb・ft. }

[5] Install the fan guide stay to the fan guide.
tightening torque: 45 N・m { 4.6 kgf・m / 33 lb・ft. }




| | |
|---|---|
| 1 | Fan guide stay |
| 2 | Fan guide |
| 3 | Fan guide bracket |
| 4 | Spacer |



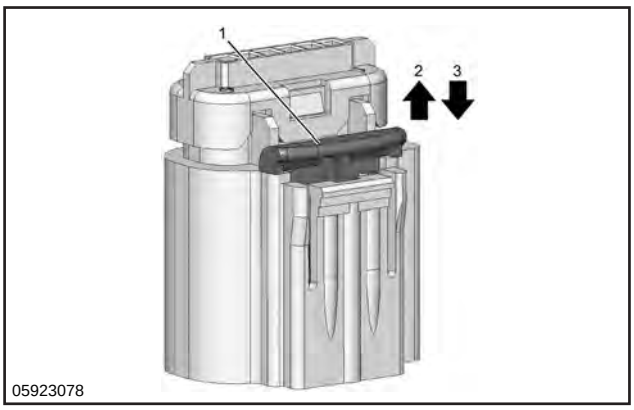

| | |
|---|---|
| 1 | Boost pressure sensor/boost temperature sensor |
| 2 | Inlet pipe |
| 3 | Gasket |
| 4 | Intake throttle valve |

[2] Install the air duct to the intake throttle valve.

[3] Connect the harness connector to the intake throttle valve.

Note

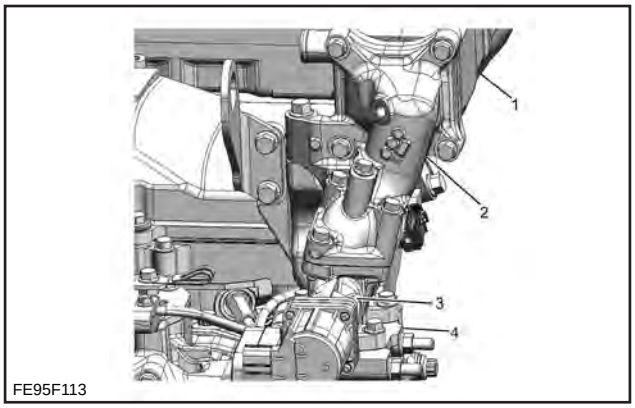
・After connecting the harness connector, press in the lock operation portion to lock.




| | |
|---|---|
| 1 | Lock operation section |
| 2 | Lock release |
| 3 | Lock |

9. EGR valve installation

[1] Install the EGR valve to the EGR pipe D. tightening torque: 24 N・m { 2.4 kgf・m / 17 lb・ft. }




| | |
|---|---|
| 1 | EGR cooler C |
| 2 | EGR pipe C |
| 3 | EGR valve |
| 4 | EGR pipe D |

Caution

・Use new gaskets.

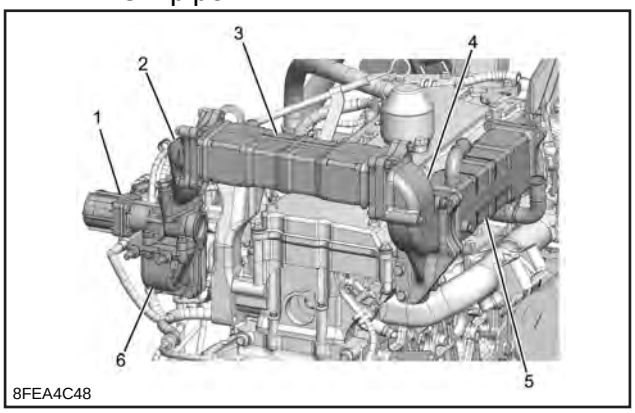
10. EGR cooler assembly installation

[1] Temporarily tighten EGR pipe C to the EGR valve.

[2] Temporarily tighten EGR cooler B to EGR pipe C.

[3] Temporarily tighten EGR pipe B to EGR cooler B.

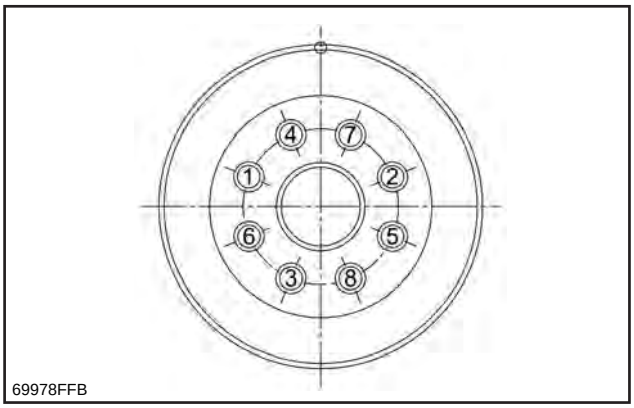
[4] Temporarily tighten EGR cooler A to EGR pipe B.




| | |
|---|---|
| 1 | EGR valve |
| 2 | EGR pipe C |
| 3 | EGR cooler B |
| 4 | EGR pipe B |
| 5 | EGR cooler A |
| 6 | EGR pipe D |

36. Flywheel removal
[1] Remove the flywheel from the crankshaft.

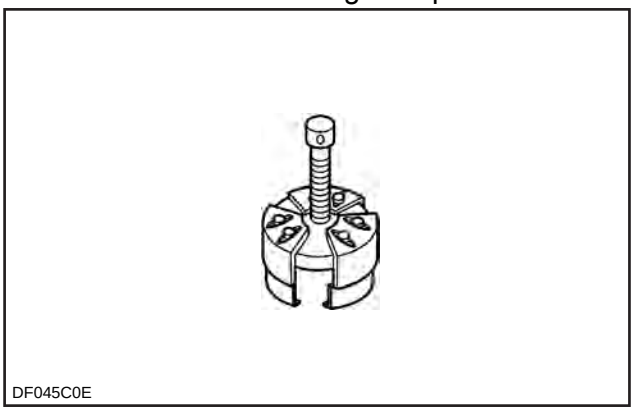
Note
・Gradually loosen the flywheel installation bolts in the order shown in the diagram.



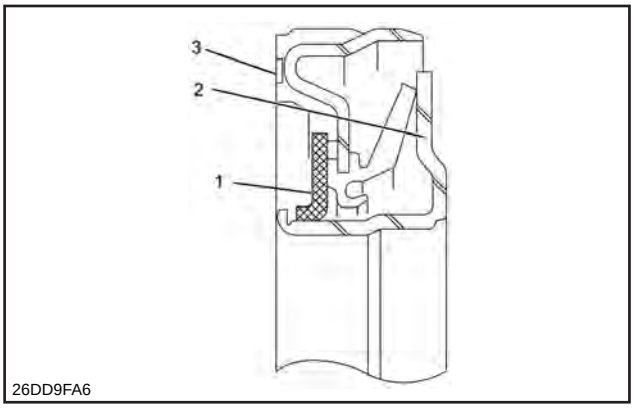
69978FFB

Caution
・Fix the flywheel firmly so that it will not rotate.

37. Crankshaft rear oil seal removal
[1] Remove the crankshaft rear oil seal from the crankshaft using the special tool.

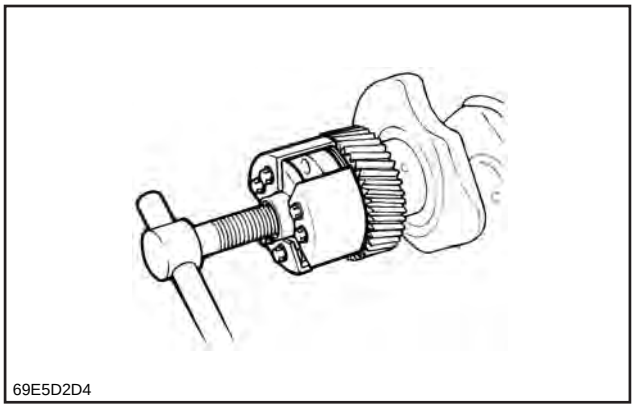

DF045C0E

SST: 5-8840-2360-0 - rear oil seal remover



26DD9FA6

| | |
|---|---|
| 1 | Felt |
| 2 | Slinger |
| 3 | Crankshaft rear oil seal |


69E5D2D4

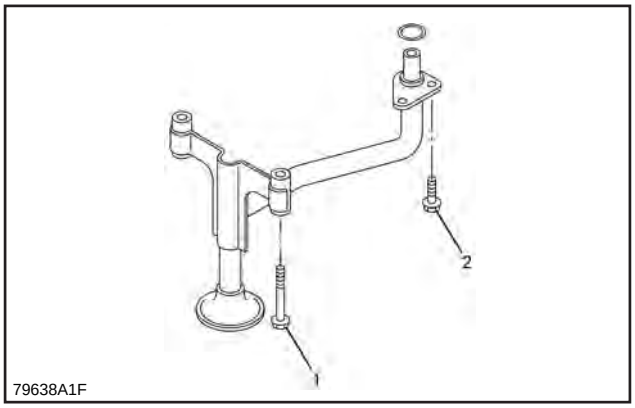
Caution
・Be careful not to damage the oil seal pressfitting surface.

Note
・Remove the slinger and oil seal together.
・If the slinger of the remover is easy to come off, the outer circumference of the jig can be tightened using a clip band to improve the workability.

38. Oil pan removal
[1] Disconnect the harness connector from the oil level switch.
[2] Remove the oil pan from the crankcase.
[3] Remove the gasket from the oil pan.

39. Oil strainer removal
[1] Remove the oil strainer from the crankcase.
[2] Remove the O-ring from the oil strainer.

Caution
・Do not reuse the O-ring.



79638A1F

| | |
|---|---|
| 1 | M10 bolt |
| 2 | M8 bolt |

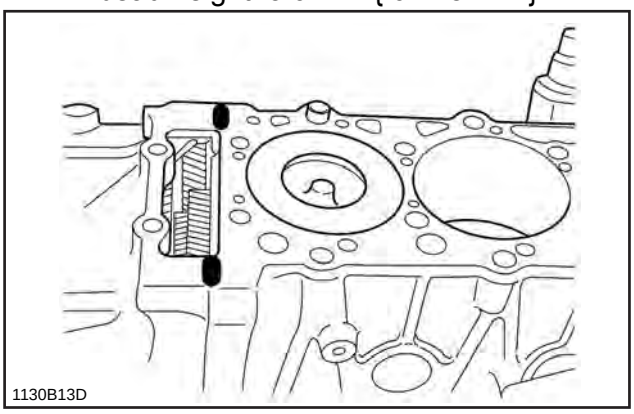
40. Flywheel housing removal
[1] Remove the cover from the flywheel housing.

[1] Apply the liquid gasket to the cylinder block.

Note

・Use ThreeBond 1207B.

bead width: 3.0 mm { 0.1181 in. }
bead height: 3.0 mm { 0.1181 in. }




Caution

・After applying liquid gasket, install the cylinder head within 5 minutes.

[2] Install the cylinder head gasket to the cylinder block.

Caution

・Use a new cylinder head gasket.

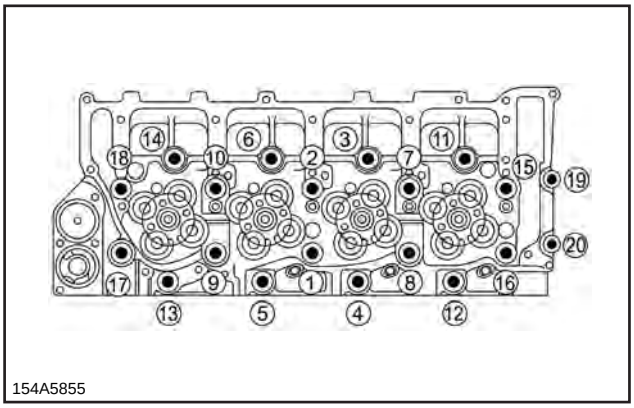
[3] Install the cylinder head assembly to the cylinder block.

Caution

・Be careful not to damage the cylinder head gasket.

Note

・Tightening order of the head bolts




Note

・1 - 18 in the diagram indicate the M14 bolts.
・19 and 20 in the diagram indicate the M10 bolts.

[4] Prepare the head bolt.

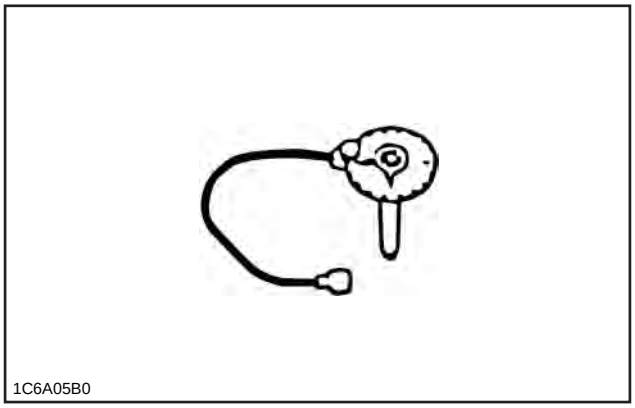
Note

・Apply molybdenum disulfide grease to the seat surface and threaded portion of the M14 head bolts.
・Apply engine oil to the seat surface and threaded portion of the M10 head bolts.

[5] Tighten the head bolt using the torque wrench.
tightening torque: 157 N・m { 16.0 kgf・m / 116 lb・ft. }

[6] Tighten the head bolt using the torque wrench.
tightening torque: 165 N・m { 16.8 kgf・m / 122 lb・ft. }

[7] Tighten the head bolt using the special tool.




SST: 5-8840-0266-0 - angle gauge

tightening angle: 55 ° M14 bolt

[8] Tighten the head bolt using the torque wrench.
tightening torque: 38 N・m { 3.9 kgf・m / 28 lb・ft. } M10 bolt

[9] Tighten the head bolt using the torque wrench.
tightening torque: 167 N・m { 17.0 kgf・m / 123 lb・ft. } Check the tightening M14 bolt

20. Bridge installation

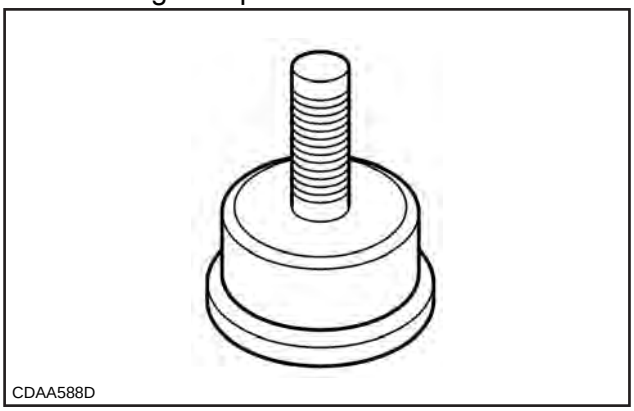
[1] Apply the engine oil to the bridge.

[2] Install the bridge to the bridge guide.

Caution

・Confirm that the bridge moves smoothly.

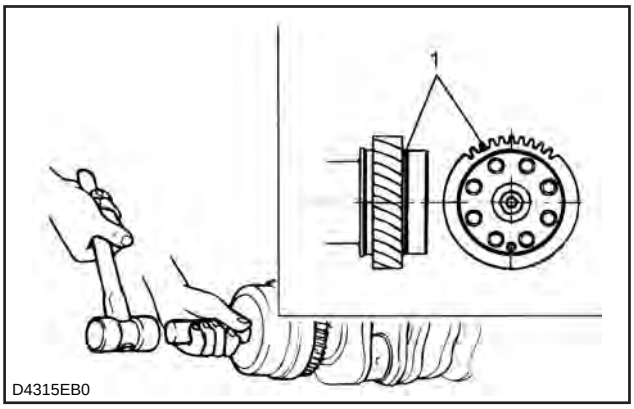
[2] Install the crank gear to the crankshaft using the special tool.




SST: 8-9439-6819-0 - crankshaft gear installer

Note

・Turn the crank gear so that




| | |
|---|---|
| 1 | Alignment mark |

## Inspection of Crankshaft

1. Crankshaft inspection

[1] Inspect the crankshaft.

Caution

・Replace the crankshaft if damage such as a crack has been found in the inspection.

[2] Put the crankshaft on V-block.

Note

・Hold the No.1 and No.5 journal sections.

[3] Prepare the dial gauge.

[4] Turn the crankshaft.

: 1 rotations

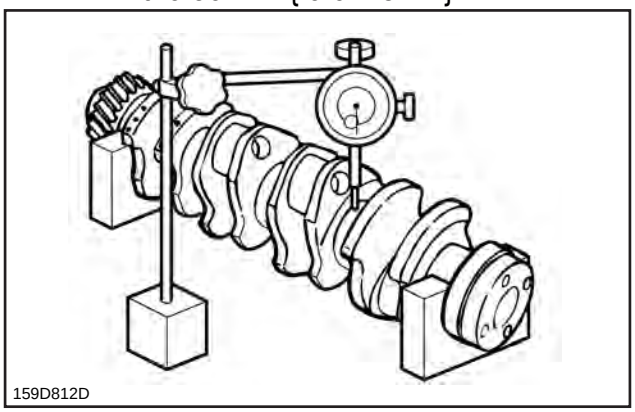
Caution

・Rotate the crankshaft slowly.

[5] Measure the fluctuation using the dial gauge.

specified value: less than 0.05 mm { less than 0.0020 in. } or less

limit: 0.30 mm { 0.0118 in. }




Caution

・Replace the crankshaft if the measured value exceeds the limit value.

[6] Measure the crankshaft using the micrometer.

Note

・Outer diameter of the crankshaft journal

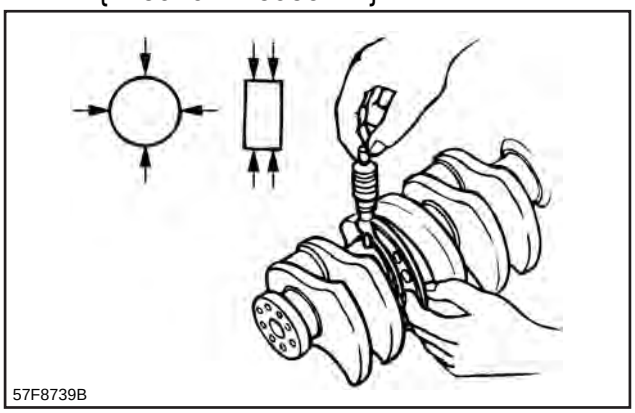
specified value: 81.891 - 81.911 mm { 3.2240 - 3.2248 in. } No.3 journal

specified value: 81.905 - 81.925 mm { 3.2246 - 3.2254 in. } Other than No. 3 journal

Note

・Outer diameter of the crankshaft pin

specified value: 65.902 - 65.922 mm { 2.5946 - 2.5953 in. }



[4] Prepare the head bolt.

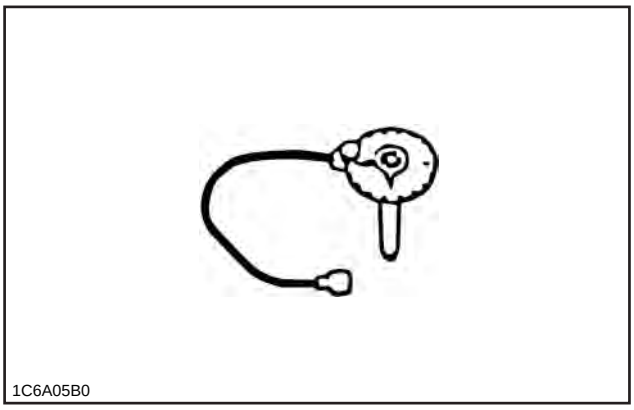
Note

・Apply molybdenum disulfide grease to the seat surface and threaded portion of the M14 head bolts.
・Apply engine oil to the seat surface and threaded portion of the M10 head bolts.

[5] Tighten the head bolt using the torque wrench.
tightening torque: 157 N・m { 16.0 kgf・m / 116 lb・ft. }

[6] Tighten the head bolt using the torque wrench.
tightening torque: 165 N・m { 16.8 kgf・m / 122 lb・ft. }

[7] Tighten the head bolt using the special tool.




SST: 5-8840-0266-0 - angle gauge

tightening angle: 55 ° M14 bolt

[8] Tighten the head bolt using the torque wrench.
tightening torque: 38 N・m { 3.9 kgf・m / 28 lb・ft. } M10 bolt

[9] Tighten the head bolt using the torque wrench.
tightening torque: 167 N・m { 17.0 kgf・m / 123 lb・ft. } Check the tightening M14 bolt

3. Bridge installation

[1] Apply the engine oil to the bridge.

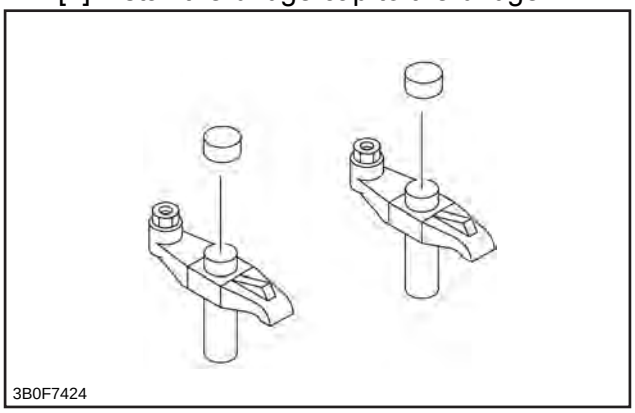
[2] Install the bridge to the bridge guide.

Caution

・Confirm that the bridge moves smoothly.

[3] Apply the engine oil to the bridge cap.

[4] Install the bridge cap to the bridge.

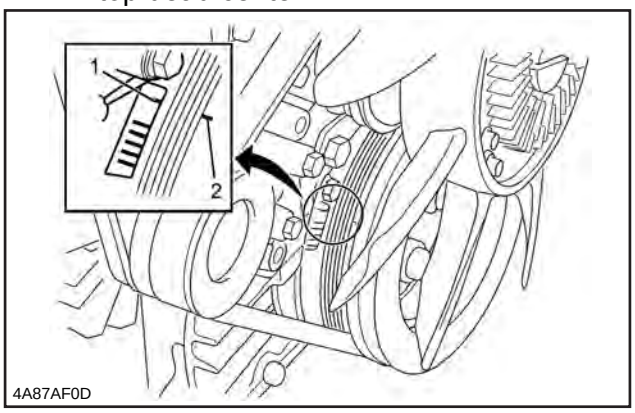



Caution

・Be careful not to drop the bridge cap into the engine.

4. Camshaft installation

[1] Align No.1 cylinder to the compression top dead center.




| | |
|---|---|
| 1 | Front cover marking |
| 2 | 0 degree marking on the crankshaft damper |

[2] Apply the engine oil to the camshaft bearing.

Note

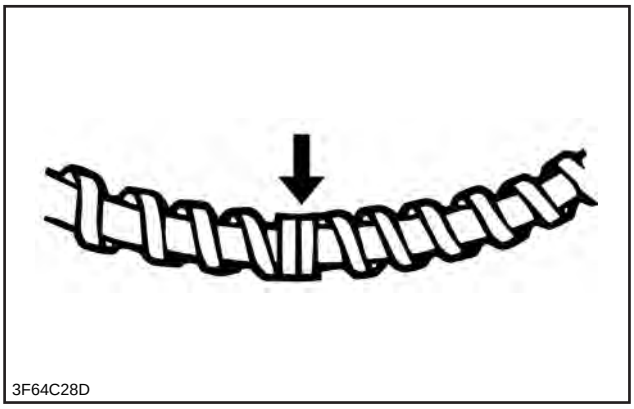
・Apply engine oil to the sliding surface of the bearing.

Caution

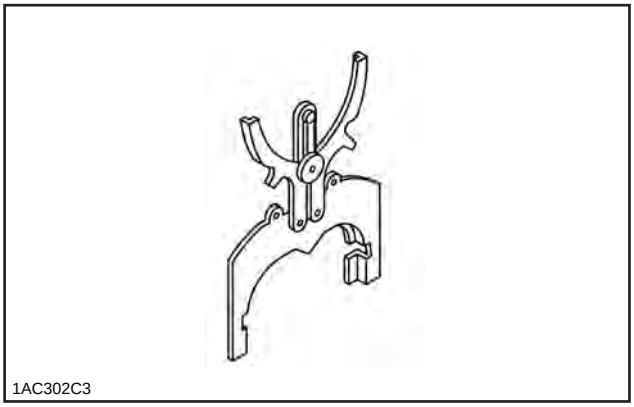
・Apply engine oil after cleaning the bearing installation sections of the camshaft bearing and cylinder head.

Caution

・Assemble the oil ring joint so that the coil expander joint is on the direct opposite.
・Check that there is no gap at the position of the arrow in the diagram when the oil ring coil expander is installed.


3F64C28D

[7] Install the third ring to the piston using the special tool.

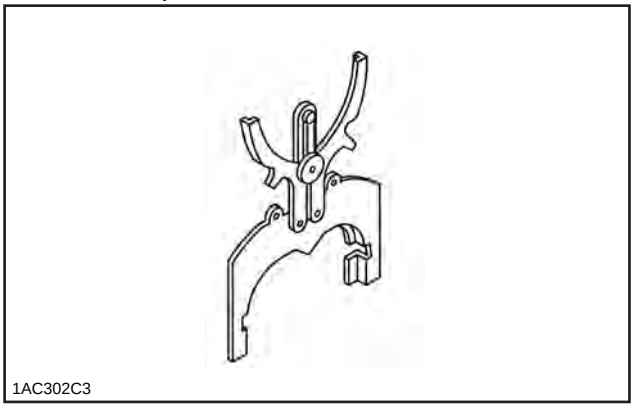

1AC302C3

SST: 1-8522-1029-0 - piston ring setting tool

Note

・Make the N mark point upward.

[8] Install the second ring to the piston using the special tool.

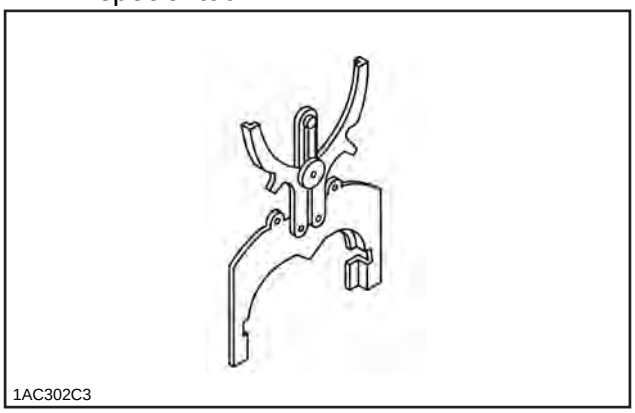

1AC302C3

SST: 1-8522-1029-0 - piston ring setting tool

Note

・Make the N mark point upward.

[9] Install the top ring to the piston using the special tool.


1AC302C3

SST: 1-8522-1029-0 - piston ring setting tool

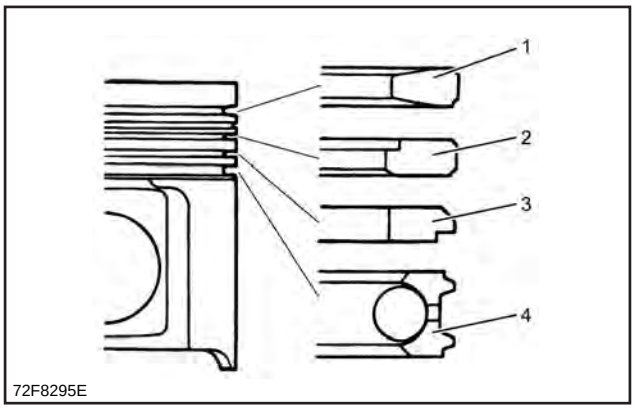
Note

・Make the N mark point upward.

[10] Apply the engine oil to the piston ring.
[11] Inspect the piston ring.

Note

・Confirm that the piston rings rotate smoothly.



72F8295E

| | |
|---|---|
| 1 | Top ring |
| 2 | Second ring |
| 3 | Third ring |
| 4 | Oil ring |

## Inspection of Piston

1. Piston ring inspection

Caution

・Clean the inspection target section thoroughly before starting inspection.

Note

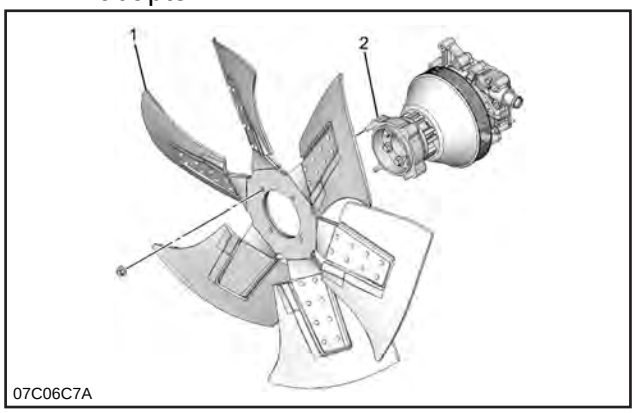
・Clearance inspection of the piston ring joint

## Removal and installation of Crankshaft Front Oil Seal

### Removal of Crankshaft Front Oil Seal

1. Cooling fan removal

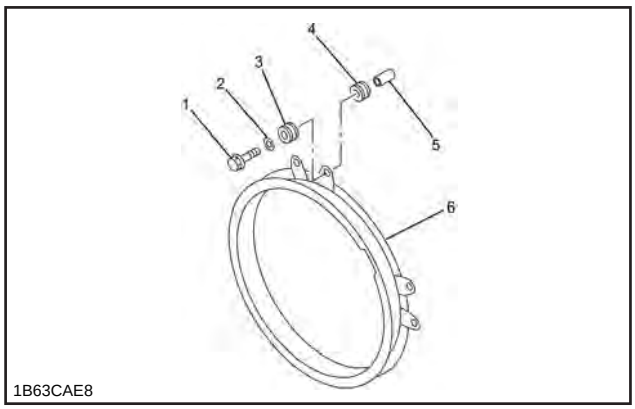
[1] Remove the cooling fan from the adapter.




| | |
|---|---|
| 1 | Cooling fan |
| 2 | Adapter |

2. Fan guide removal

[1] Remove the fan guide from the fan guide bracket.

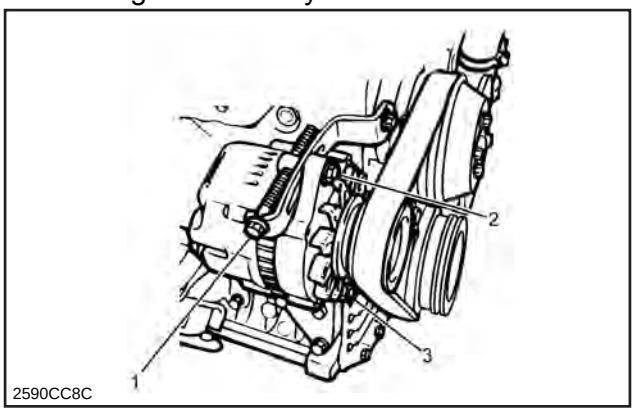



| | |
|---|---|
| 1 | Bolt |
| 2 | Washer |
| 3 | Rubber mount |
| 4 | Rubber mount |
| 5 | Guide tube |
| 6 | Fan guide |

[2] Remove the fan guide bracket from the engine assembly.

3. Cooling fan belt removal

[1] Remove the cooling fan belt from the engine assembly.




| | |
|---|---|
| 1 | Adjust bolt |
| 2 | Fixing bolt |
| 3 | Fixing bolt |

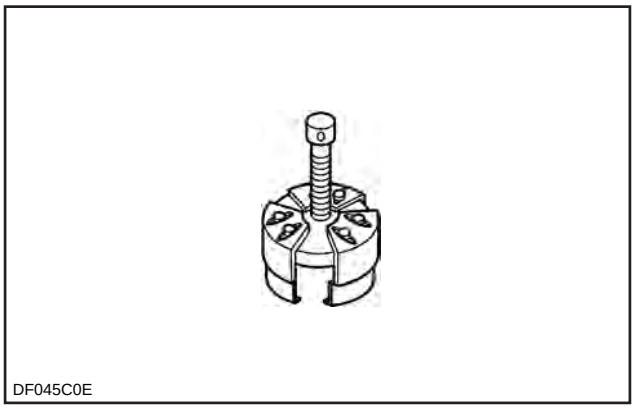
4. Crankshaft pulley removal

[1] Remove the crankshaft pulley from the crankshaft.

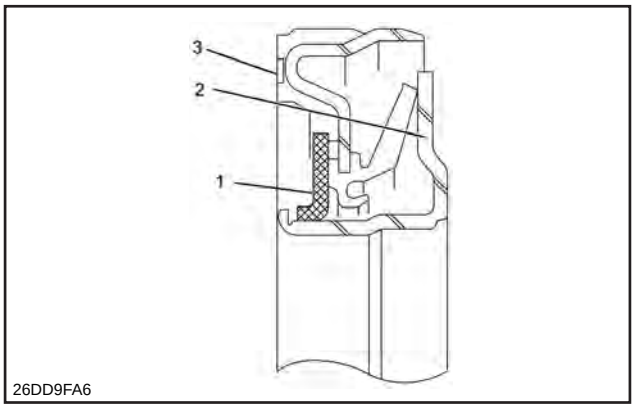
[2] Remove the crankshaft damper from the crankshaft pulley.

5. Crankshaft front oil seal removal

[1] Remove the crankshaft front oil seal from the crankshaft using the special tool.

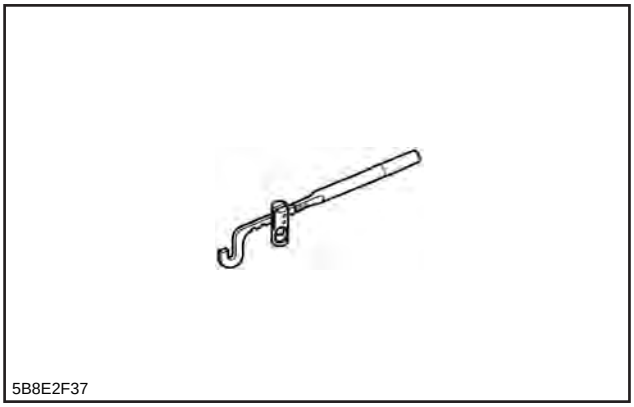



SST: 5-8840-2360-0 - rear oil seal remover

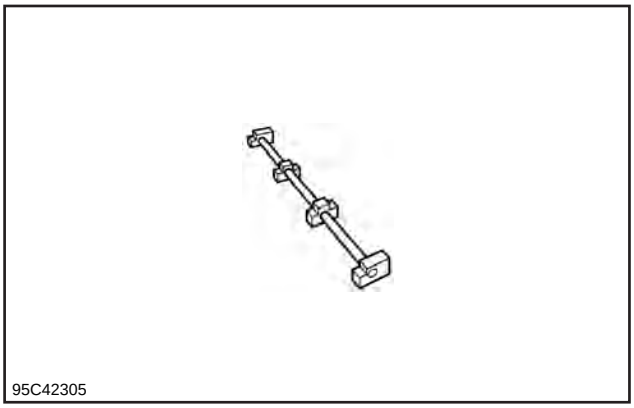



| | |
|---|---|
| 1 | Felt |
| 2 | Slinger |
| 3 | Crankshaft front oil seal |

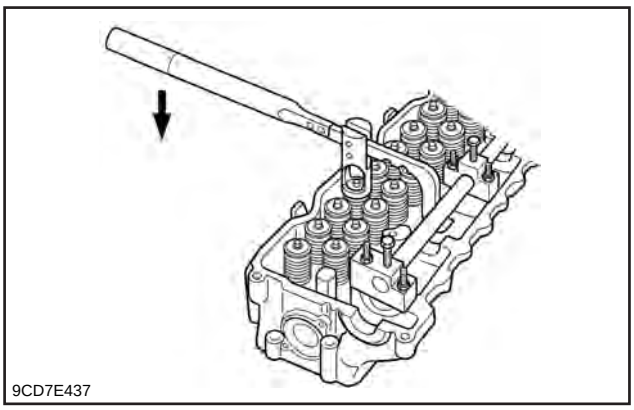
[2] Press the valve spring using the special tool.




SST: 5-8840-2621-0 - valve spring replacer




SST: 8-9439-6862-0 - pivot ASM




[3] Remove the split collar from the spring seat.

[4] Remove the special tool from the cylinder head assembly.

[5] Remove the valve spring seat from the valve spring.

[6] Remove the valve spring from the cylinder head assembly.

Note

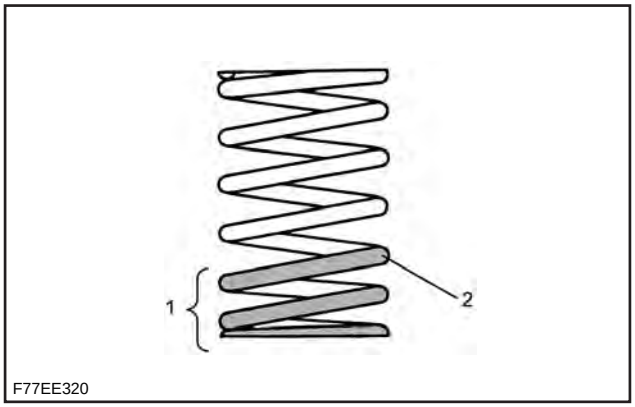
・Store the removed valve springs according to the cylinders.

## Installation of Valve Spring

1. Valve spring installation

[1] Check the identification paint of the valve spring.

| Valve spring identification paint | |
|---|---|
| Inlet | Light blue |
| Exhaust | White |




| | |
|---|---|
| 1 | Spring pitch (small) |
| 2 | Identification paint |

[2] Install the valve spring to the cylinder head assembly.

Note

・Turn the valve spring to face the identification paint application area towards the cylinder head assembly.

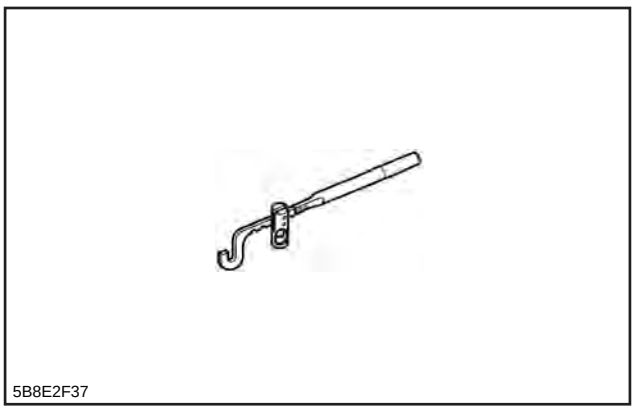
[3] Install the spring seat to the valve spring.

[4] Secure the valve using air.

Note

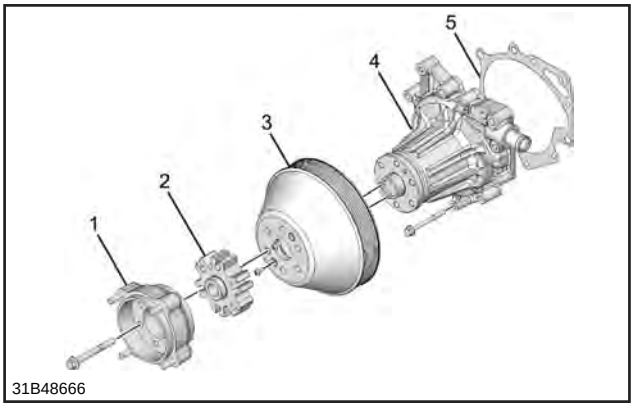
・Secure the valve on the closed position by blowing the compressed air into the cylinder from the glow plug hole.

[5] Press the valve spring using the special tool.




SST: 5-8840-2621-0 - valve spring replacer

[6] Remove the water pump assembly from the front cover.




| | |
|---|---|
| 1 | Adapter |
| 2 | Spacer |
| 3 | Fan pulley |
| 4 | Water pump assembly |
| 5 | Gasket |

9. Front cover removal

[1] Remove the front cover from the cylinder block.

## Installation of Front Cover

1. Front cover installation

[1] Clean the cylinder block using the scraper.

[2] Apply the liquid gasket to the front cover.

Note

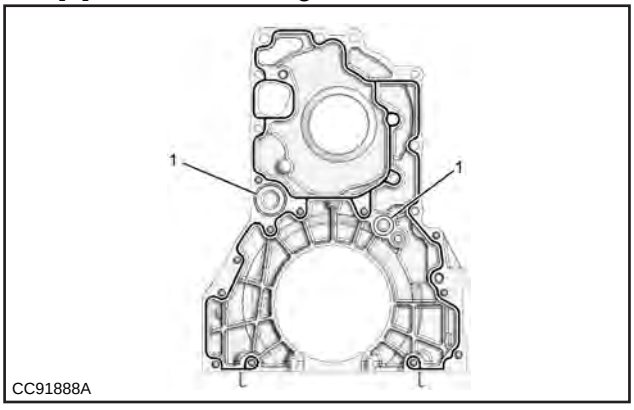
・Use ThreeBond 1207B.

bead width: 1.5 - 5.0 mm { 0.0591 - 0.1969 in. }
bead height: 0.3 - 1.5 mm { 0.0118 - 0.0591 in. }

Caution

・After applying the liquid gasket, install the front cover within 5 minutes.

[3] Install the O-ring to the front cover.




| | |
|---|---|
| 1 | O-ring |

[4] Install the front cover to the cylinder block.

Caution

・Pay attention to the knock pin position of the cylinder block.

tightening torque: 24 N・m { 2.4 kgf・m / 17 lb・ft. }

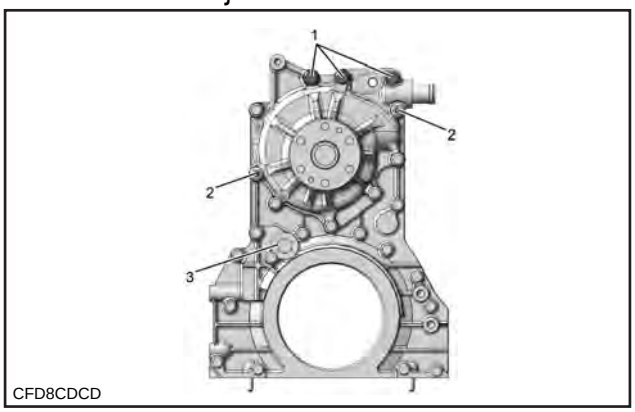
2. Water pump assembly installation

[1] Install the water pump assembly to the front cover.

Caution

・Use new gaskets.

tightening torque: 52 N・m { 5.3 kgf・m / 38 lb・ft. } 1 bolt in the diagram
tightening torque: 24 N・m { 2.4 kgf・m / 17 lb・ft. }




| | |
|---|---|
| 1 | Bolt |
| 2 | Stud bolt |
| 3 | Oil relief valve |

[2] Connect the water hose to the water pump assembly.

[3] Connect the water return pipe to the water pump assembly.
tightening torque: 35 N・m { 3.6 kgf・m / 26 lb・ft. }

[4] Install the fan pulley to the water pump assembly.
tightening torque: 10 N・m { 1.0 kgf・m / 7 lbf・ft. }

[5] Align the spacer to the adapter.

[6] Install the adapter to the water pump assembly.
tightening torque: 45 N・m { 4.6 kgf・m / 33 lb・ft. }

[5] Install the field coil to the rear bracket.
tightening torque: 3 N・m { 0.3 kgf・m / 2 lbf・ft. }

Caution
・Complete soldering operation within 5 seconds.

[6] Install the stator to the rectifier.

Note
・nstall the 4 stator coil lead wires on the rectifier.

Caution
・Complete soldering operation within 5 seconds.

[7] Install the bearing to the rotor.

Caution
・Do not reuse the bearing once it is removed.

[8] Install the bearing to the front bracket.

Note
・Heat the bearing insertion section of the front bracket.

Caution
・Do not reuse the bearing once it is removed.

[9] Install the retainer to the front bracket.
tightening torque: 8 N・m { 0.8 kgf・m / 6 lbf・ft. }

[10] Install the color to the rotor.

[11] Install the rotor to the front bracket using the press.

[12] Install the generator pulley to the rotor.
tightening torque: 97 N・m { 9.9 kgf・m / 72 lb・ft. }

Note
・Install the fan and pulley in order to the shaft of the rotor, then tighten the pulley tightening nut.

[13] Connect the front bracket to the rear bracket.

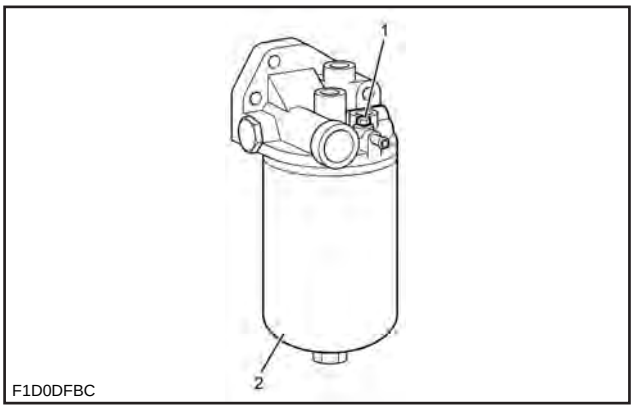
Note
・Heat the bearing insertion section of the rear bracket.

Caution
・After assembling the generator, rotate the pulley using your hands and confirm that the rotor turns smoothly.

[10] Stop the engine.

Note

・The following applies to the cartridge-type specification.




| | |
|---|---|
| 1 | Air bleeding plug |
| 2 | Cartridge-type element |

[11] Prepare a pan.

[12] Turn ON the ignition switch.

[13] Loosen the air bleeding plug using a wrench.

Note

・Check that fuel comes out from around the plug.

[14] Tighten the air bleeding plug using a wrench.
tightening torque: 10 N・m { 1.0 kgf・m / 7 lbf・ft. }

Caution

・Fully remove any fuel in the area after tightening the plug.

[15] Start the engine.

Note

・Idle the engine for 5 seconds.

Caution

・Do not change the engine speed when the engine is started.
・If the engine does not start, repeat the process from step 12.

Note

・Slowly increase the engine speed, and maintain it for 3 minutes.
・Increase the engine speed to the maximum speed.

[16] Stop the engine.

## Removal and installation of DEF Sensor

### Removal of DEF Sensor

1. Battery ground cable disconnect

[1] Disconnect the battery ground cable from the battery.

> ⚠ Caution
>
> ・While the indicator (LED) of the battery disconnect switch is lit, do not turn OFF the battery disconnect switch or disconnect its negative cable from the battery. (After key OFF, lit for a maximum duration of 3 minutes)

2. DEF sensor removal

[1] Disconnect the urea fluid piping from the urea fluid sensor.

> ⚠ Caution
>
> ・If the connector is dirty, clean off the dirt with compressed air, etc., before removing the parts.
>
> ・After removing, cover the connector and mating pipe with a plastic bag, etc., to prevent dirt, etc., from becoming attached.

[2] Disconnect the breather hose from the urea fluid sensor.

[3] Disconnect the connector from the urea fluid sensor.

[4] Remove the urea fluid sensor from the urea fluid tank.

[5] Remove the O-ring from the urea fluid sensor.

> ⚠ Caution
>
> ・Do not reuse the O-ring.
>
> ・If the sensor is dropped, do not reuse it.

### Installation of DEF Sensor

1. DEF sensor installation

[1] Apply grease to the O-ring.

[2] Install the O-ring to the urea fluid sensor.

> ⚠ Caution
>
> ・Do not reuse the O-ring.

[3] Install the urea fluid sensor to the urea fluid tank.

> ⚠ Caution
>
> ・If the sensor is dropped, do not reuse it.
>
> ・When removing foreign material, wipe off with a clean cloth.

[4] Connect the connector to the urea fluid sensor.

[5] Connect the breather hose to the urea fluid sensor.

[6] Connect the urea fluid piping to the urea fluid sensor.

2. Battery ground cable connect

[1] Connect the battery ground cable to the battery.

[6] Perform a test-run under the conditions for running the DTC.

Note

・Conditions for setting engine run time or coolant temperature vary depending on the DTCs.
・For the conditions for setting the DTC, refer to the applicable code listed in 15E DTC information.

[7] Check the DTC.
[8] If a DTC has been detected, replace the control unit of the machine.
[9] Connect all harnesses.
[10] Clear the DTC using the trouble diagnosis scan tool.
[11] Turn OFF the ignition switch for at least 30 seconds.
[12] Perform a test-run under the conditions for running the DTC.

Note

・Conditions for setting engine run time or coolant temperature vary depending on the DTCs.
・For the conditions for setting the DTC, refer to the applicable code listed in 15E DTC information.

[13] Check the DTC.
[14] If a DTC has been detected, replace the ECM.
Refer to "ECM removal".
Refer to "ECM installation".
[15] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.

2. DTC U0101 confirm resolution
[1] Clear the DTC using the trouble diagnosis scan tool.
[2] Turn OFF the ignition switch for at least 30 seconds.
[3] Start the engine.
[4] Perform a test-run under the conditions for running the DTC.

Note

・Conditions for setting engine run time or coolant temperature vary depending on the DTCs.
・For the conditions for setting the DTC, refer to the applicable code listed in 15E DTC information.

[5] Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0102 Mass Air Flow Sensor Circuit Low Input

1. DTC P0102 priority DTC
DTC P0560
2. DTC P0102 diagnostics
[1] Turn OFF the ignition switch.
[2] Disconnect the harness connector from the MAF sensor.
[3] Inspect to see if there is an open circuit or high resistance in the 12 V power supply circuit between the ECM and the MAF sensor.
[4] If a problem is found, repair the 12 V power supply circuit.
[5] Connect the test cable with fuse between the 12 V power supply circuit and the signal circuit of the MAF sensor harness connector.
[6] Check the MAF sensor display with the trouble diagnosis scan tool.
voltage: 4.9 V
[7] If the reading is more than or equal to the specified value, inspect to see if there is a poor connection with the MAF sensor harness connector.
[8] If a problem is found, repair the harness connector.
[9] If the harness connector is normal, replace the MAF sensor.
[10] Inspect the signal circuit between the ECM and the MAF sensor.
・ There should be no open circuit or high resistance.
・ There should be no short to GND.
[11] If a problem is found, repair the signal circuit.
[12] Inspect the ECM harness connector for a poor connection.
[13] If a problem is found, repair the harness connector.
[14] If the harness connector is normal, replace the ECM.
Refer to "ECM removal".
Refer to "ECM installation".
[15] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.
3. DTC P0102 confirm resolution
[1] Clear the DTC using the trouble diagnosis scan tool.

[10] Measure the voltage between the signal circuit of the CKP sensor harness connector and a normal GND again.
voltage: 4.5 V

[11] If the reading is less than or equal to the specified value, inspect the signal circuit between the ECM and the CKP sensor.
- There should be no open circuit or high resistance.
- There should be no short to GND.

[12] If a problem is found, repair the signal circuit.

[13] Connect the test light between the signal circuit and normal GND of the CKP sensor harness connector.

[14] Measure the voltage between the probe of the test light and a normal GND.
voltage: 4.5 V

[15] If the reading is more than or equal to the specified value, inspect to see if there is a short circuit to the 5 V power supply circuit with the signal circuit between the ECM and the CKP sensor.

[16] If a problem is found, repair the signal circuit.

[17] Measure the voltage between the 5 V power supply circuit and GND circuit of the CKP sensor harness connector.
voltage: 4.5 V

[18] If the reading is more than or equal to the specified value, inspect to see if there is a poor connection with the CKP sensor harness connector.

[19] If a problem is found, repair the harness connector.

[20] If the harness connector is normal, inspect the CKP sensor.
Refer to "CKP sensor inspection".

[21] If a problem is found, replace the CKP sensor.
Refer to "CKP sensor removal".
Refer to "CKP sensor installation".

[22] Inspect the GND circuit between the ECM and the CKP sensor for an open circuit and high resistance.

Note

- The CKP sensor shares the GND circuit with other sensors.
- The DTC set on a sensor which shares this circuit may be detected.

[23] If a problem is found, repair the GND circuit.

[24] Inspect the ECM harness connector for a poor connection.

[25] If a problem is found, repair the harness connector.

[26] If the harness connector is normal, replace the ECM.
Refer to "ECM removal".
Refer to "ECM installation".

[27] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.

3. DTC P0335 confirm resolution

[1] Clear the DTC using the trouble diagnosis scan tool.

[2] Turn OFF the ignition switch for at least 30 seconds.

[3] Start the engine.

[4] Perform a test-run under the conditions for running the DTC.

Note

- Conditions for setting engine run time or coolant temperature vary depending on the DTCs.
- For the conditions for setting the DTC, refer to the applicable code listed in 15E DTC information.

[5] Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0336 Crankshaft Position Sensor Circuit Range/Performance

1. DTC P0336 priority DTC
DTC P0335
DTC P0340
DTC P06A6

2. DTC P0336 diagnostics

[1] Inspect the CKP sensor circuit.
- There should be enough clearing from the wiring or component of the fuel injection unit.
- There should be enough clearing from additionally installed electronic components.
- There should be enough clearing from the solenoids and relays.

[2] If a problem is found, repair the CKP sensor circuit.

[3] Turn OFF the ignition switch.

[4] Disconnect the harness connector from the ECM.

Refer to "Intake throttle valve installation".

[4] Turn OFF the ignition switch.

[5] Disconnect the harness connector from the intake throttle valve.

[6] Inspect the intake throttle valve harness connector for a poor connection.

[7] If a problem is found, repair the harness connector.

[8] Disconnect the harness connector from the ECM.

[9] Inspect the ECM harness connector for a poor connection.

[10] If a problem is found, repair the harness connector.

[11] Inspect the intake throttle valve circuit for high resistance.

[12] If a problem is found, repair the circuit.

[13] Inspect the motor circuit between the ECM and the intake throttle valve.

- There should be no short to GND.
- There should be no short to the battery or the ignition power supply.
- There should be no short together between motor circuits.
- There should be no short to the intake throttle position sensor circuit.

[14] If a problem is found, repair the motor circuit.

[15] If the motor circuit is normal, replace the intake throttle valve.
Refer to "Intake throttle valve removal".
Refer to "Intake throttle valve installation".

[16] Restore the machine.

[17] Turn ON the ignition switch.

[18] Turn OFF the ignition switch for at least 30 seconds.

Note

- The ignition switch must be once turned ON and then turned OFF before clearing the DTC.

[19] Clear the DTC using the trouble diagnosis scan tool.

[20] Turn OFF the ignition switch for at least 30 seconds.

[21] Start the engine.

[22] Use the trouble diagnosis scan tool to check if a DTC has been detected.

[23] If a DTC has been detected, replace the ECM.
Refer to "ECM removal".
Refer to "ECM installation".

[24] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.

3. DTC P0638 confirm resolution

[1] Turn ON the ignition switch.

[2] Turn OFF the ignition switch for at least 30 seconds.

Note

- The ignition switch must be once turned ON and then turned OFF before clearing the DTC.

[3] Clear the DTC using the trouble diagnosis scan tool.

[4] Turn OFF the ignition switch for at least 30 seconds.

[5] Start the engine.

[6] Perform a test-run while the intake throttle motor drive duty is 20 % or more.

[7] Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0685 ECM Power Relay Control Circuit Open

1. DTC P0685 diagnostics

[1] Turn OFF the ignition switch for at least 30 seconds.

[2] Replace the main relay with a glow relay or normal relay.

[3] Turn ON the ignition switch.

[4] Use the trouble diagnosis scan tool to check if a DTC is detected.

[5] If a DTC has not been detected, replace the main relay.

[6] Inspect the body grounding terminal for a poor connection.

[7] If a problem is found, repair the terminal.

[8] Inspect the slow blow fuse.

[9] If a problem is found, replace the slow blow fuse.

Note

- When the fuse is blown again, repair the cause of slow-blow fuse blowout.

[10] Turn OFF the ignition switch.

[11] Disconnect the harness connector from the ECM.

[12] Inspect the ECM harness connector for a poor connection.

[17] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.

3. DTC P2122 confirm resolution

[1] Clear the DTC using the trouble diagnosis scan tool.

[2] Turn OFF the ignition switch for at least 30 seconds.

[3] Start the engine and fully depress and release the accelerator pedal while observing the accelerator pedal sensor 1 display on the trouble diagnosis scan tool.

[4] Confirm that the trouble diagnosis scan tool does not show a value at or below the specified value while depressing and then releasing the pedal.
voltage: 0.2 V

[5] Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P2123 Pedal Position Sensor 1 Circuit High Input

1. DTC P2123 priority DTC
DTC P06A6

2. DTC P2123 diagnostics

[1] Turn OFF the ignition switch.

[2] Disconnect the harness connector from the accelerator position sensor.

[3] Observe the accelerator pedal sensor 1 display on the trouble diagnosis scan tool.
voltage: 0.1 V

[4] If the reading is more than or equal to the specified value, inspect the sensor 1 signal circuit between the ECM and the accelerator position sensor.

- There should be no short to the battery or ignition power supply.
- There should be no short to the 5 V power supply.

[5] If a problem is found, repair the sensor 1 signal circuit.

[6] Connect the test light between the accelerator position sensor GND circuit and battery power supply.

[7] If the test light comes on, inspect the accelerator position sensor harness connector for a poor connection.

[8] If a problem is found, repair the harness connector.

[9] If the harness connector is normal, replace the accelerator position sensor.

[10] If the test light does not come on, inspect to see if there is an open circuit or high resistance with the GND circuit between the ECM and the accelerator position sensor.

[11] If a problem is found, repair the GND circuit.

[12] Inspect the ECM harness connector for a poor connection.

[13] If a problem is found, repair the harness connector.

[14] If the harness connector is normal, replace the ECM.
Refer to "ECM removal".
Refer to "ECM installation".

[15] Set the Injector ID Code, fuel delivery rate, and engine No. for the ECM.

3. DTC P2123 confirm resolution

[1] Clear the DTC using the trouble diagnosis scan tool.

[2] Turn OFF the ignition switch for at least 30 seconds.

[3] Start the engine and fully depress and release the accelerator pedal while observing the accelerator pedal sensor 1 display on the trouble diagnosis scan tool.

[4] Confirm that the trouble diagnosis scan tool does not show a value at or above the specified value while depressing and then releasing the pedal.
voltage: 4.9 V

[5] Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P2127 Pedal Position Sensor 2 Circuit Low Input

1. DTC P2127 priority DTC
DTC P06A6

2. DTC P2127 diagnostics

[1] Turn OFF the ignition switch.

[2] Disconnect the harness connector from the accelerator position sensor.

[3] Turn ON the ignition switch.

[4] Measure the voltage between the 5 V power supply circuit and GND of the accelerator position sensor.
voltage: 4.5 V

[14] If DTC P20A0 and P20B1 are set but P0658 is not set, replace the urea fluid supply module.
Refer to "DEF supply module removal".
Refer to "DEF supply module installation".

[15] Inspect the battery voltage supply circuit between the DCU and the coolant control valve for a short to any metallic components, such as the frame.

[16] If a problem is found, repair the battery voltage supply circuit.

[17] Inspect the battery voltage supply circuit between the DCU and the urea fluid supply module.

Note

- There should be no short to other GND circuits.
- There should be no short to other power supply circuits.

[18] If a problem is found, repair the battery voltage supply circuit.

[19] Turn OFF the ignition switch.

[20] Disconnect the DCU harness connector.

[21] Inspect the DCU harness connector.

Note

- There should be no intermittent conditions, poor connections, or corrosion.
- There should be no water intrusion or adhering foreign material.

[22] If a problem is found, repair the connector.

[23] Replace the DCU.
Refer to "DCU removal".
Refer to "DCU installation".

2. DTC P0658 confirm resolution

[1] Clear the DTC with the trouble diagnosis scan tool.

Note

- After clearing the DCU DTC, observe whether ECM DTC P20C9 is set.
- If DTC P20C9 is set, clear it.

[2] Turn OFF the ignition switch until communication with the trouble diagnosis scan tool is discontinued.

[3] Turn ON the ignition switch without starting the engine.

[4] Observe the DTC information with the trouble diagnosis scan tool. A DTC should not be set.

DTC P0659 Actuator Supply Voltage Circuit

1. DTC P0659 priority DTC
DTC P208D
DTC P20A3
DTC P20B4

2. DTC P0659 diagnostics

[1] Turn OFF the ignition switch.

[2] Disconnect the coolant control valve harness connector.

[3] Inspect the coolant control valve harness connector.

Note

- There should be no intermittent conditions, poor connections, or corrosion.
- There should be no water intrusion or adhering foreign material.

[4] If a problem is found, repair the connector.

[5] Turn ON the ignition switch without starting the engine.

[6] Observe the DTC information with a trouble diagnosis scan tool.

[7] If DTC P20B1 is set but P0659 is not set, replace the coolant control valve.
Refer to "Coolant control valve removal".
Refer to "Coolant control valve installation".

[8] Turn OFF the ignition switch.

[9] Disconnect the urea fluid supply module harness connector.

Note

- The urea fluid pump, reverting valve, and urea fluid pressure sensor are built in.

[10] Inspect the urea fluid supply module harness connector.

Note

- There should be no water intrusion or adhering foreign material.
- There should be no intermittent conditions, poor connections, or corrosion.

[11] If a problem is found, repair the connector.

[4] Check if the following parameters change to "No" on the trouble diagnosis scan tool.
- Urea fluid concentration sensor error
- Urea fluid conductivity sensor error
- Urea fluid tank temperature sensor error
- Urea fluid sensor error

[5] Observe the DTC information with a trouble diagnosis scan tool. A DTC should not be set.

DTC P207F Urea Fluid Concentration Too Low

1. DTC P207F diagnostics

[1] Inspect the concentration of the urea fluid.

[2] If a problem is found, add the specified urea fluid after cleaning the inside of the urea fluid tank.

[3] Inspect the urea fluid tank.
- There should be no water intrusion caused by cracking or damage.

[4] If a problem is found, replace the urea fluid tank.

[5] Inspect the urea fluid sensor.
- There should be no coolant intrusion caused by cracking or damage of the coolant passages.
- There should be no water intrusion from the urea fluid sensor installation area or seal area.

[6] Clear the DTC with the trouble diagnosis scan tool.

[7] Turn OFF the ignition switch until communication with the trouble diagnosis scan tool is discontinued.

[8] Turn ON the ignition switch without starting the engine.

[9] Observe the DTC information with a trouble diagnosis scan tool. DTC P207F should not be set.

[10] If DTC P207F is set, replace the urea fluid sensor.

2. DTC P207F confirm resolution

[1] Clear the DTC with the trouble diagnosis scan tool.

[2] Turn OFF the ignition switch until communication with the trouble diagnosis scan tool is discontinued.

[3] Turn ON the ignition switch without starting the engine.

[4] Observe the DTC information with the trouble diagnosis scan tool. A DTC should not be set.

DTC P208A Urea Fluid Pump Control Circuit

1. DTC P208A diagnostics

[1] Turn OFF the ignition switch.

[2] Disconnect the urea fluid supply module harness connector.

[3] Inspect the urea fluid supply module harness connector.

Note
- There should be no intermittent conditions, poor connections, or corrosion for any of the terminals.
- There should be no open circuit, high resistance, or short to any of the circuits.
- There should be no water intrusion or adhering foreign material.

[4] If a problem is found, repair the connector.

[5] Turn OFF the ignition switch.

[6] Disconnect the DCU harness connector.

[7] Inspect the DCU harness connector.

Note
- There should be no intermittent conditions, poor connections, or corrosion.
- There should be no water intrusion or adhering foreign material.

[8] If a problem is found, repair the connector.

[9] Inspect the urea fluid pump power supply circuit between the DCU and the urea fluid supply module harness connector for an open circuit or high resistance.

[10] If a problem is found, repair the pump power supply circuit.

[11] Inspect the GND circuit between the DCU and the urea fluid supply module harness connector for an open circuit or high resistance.

[12] If a problem is found, repair the GND circuit.

[13] Inspect the pump control circuit between the DCU and the urea fluid supply module harness connector for an open circuit.

2. DTC P242C confirm resolution

[1] Clear the DTC with the trouble diagnosis scan tool.

Note

- After clearing the DCU DTC, observe whether ECM DTC P20C9 is set.
- If DTC P20C9 is set, clear it.

[2] Turn OFF the ignition switch until communication with the trouble diagnosis scan tool is discontinued.

[3] Turn ON the ignition switch without starting the engine.

[4] Observe the DTC information with the trouble diagnosis scan tool. A DTC should not be set.

DTC P242D Exhaust Gas Temperature (EGT) Sensor 3 Circuit High Voltage

1. DTC P242D diagnostics

[1] Turn OFF the ignition switch.

[2] Disconnect the EGT sensor 3 harness connector.

[3] Turn ON the ignition switch.

[4] Measure the voltage between the signal circuit and the DCU harness GND connection.
values: 5.2 V

[5] If the reading is more than or equal to the specified value, inspect the signal circuit between the DCU and EGT sensor 3 for a short to the battery or a short to the ignition power supply.

Note

- EGT sensor 3 may be damaged if the sensor signal circuit is shorted to the power supply.

[6] If a problem is found, repair the signal circuit.

[7] If the reading is less than or equal to the specified value, inspect the signal circuit between the DCU and EGT sensor 3 for an open circuit or high resistance.

[8] If a problem is found, repair the signal circuit.

[9] Measure the voltage between the signal circuit and the GND circuit.
values: 4.6 V

[10] If the reading is less than or equal to the specified value, inspect the GND circuit between the DCU and EGT sensor 3 for an open circuit or high resistance.

[11] If a problem is found, repair the GND circuit.

[12] Inspect the EGT sensor 3 harness connector.

Note

- There should be no intermittent conditions, poor connections, or corrosion.
- There should be no water intrusion or adhering foreign material.

[13] If a problem is found, repair the connector.

[14] Replace EGT sensor 3.
Refer to "Exhaust gas temperature sensor 3 removal".
Refer to "Exhaust gas temperature sensor 3 installation".

Note

- If EGT sensor 3 is replaced, reset the EGT sensor 3 data with the trouble diagnosis scan tool.

[15] Turn OFF the ignition switch.

[16] Disconnect the DCU harness connector.

[17] Inspect the DCU harness connector.

Note

- There should be no intermittent conditions, poor connections, or corrosion.
- There should be no water intrusion or adhering foreign material.

[18] If a problem is found, repair the connector.

[19] Replace the DCU.
Refer to "DCU removal".
Refer to "DCU installation".

2. DTC P242D confirm resolution

[1] Clear the DTC with the trouble diagnosis scan tool.

Note

- After clearing the DCU DTC, observe whether ECM DTC P20C9 is set.
- If DTC P20C9 is set, clear it.

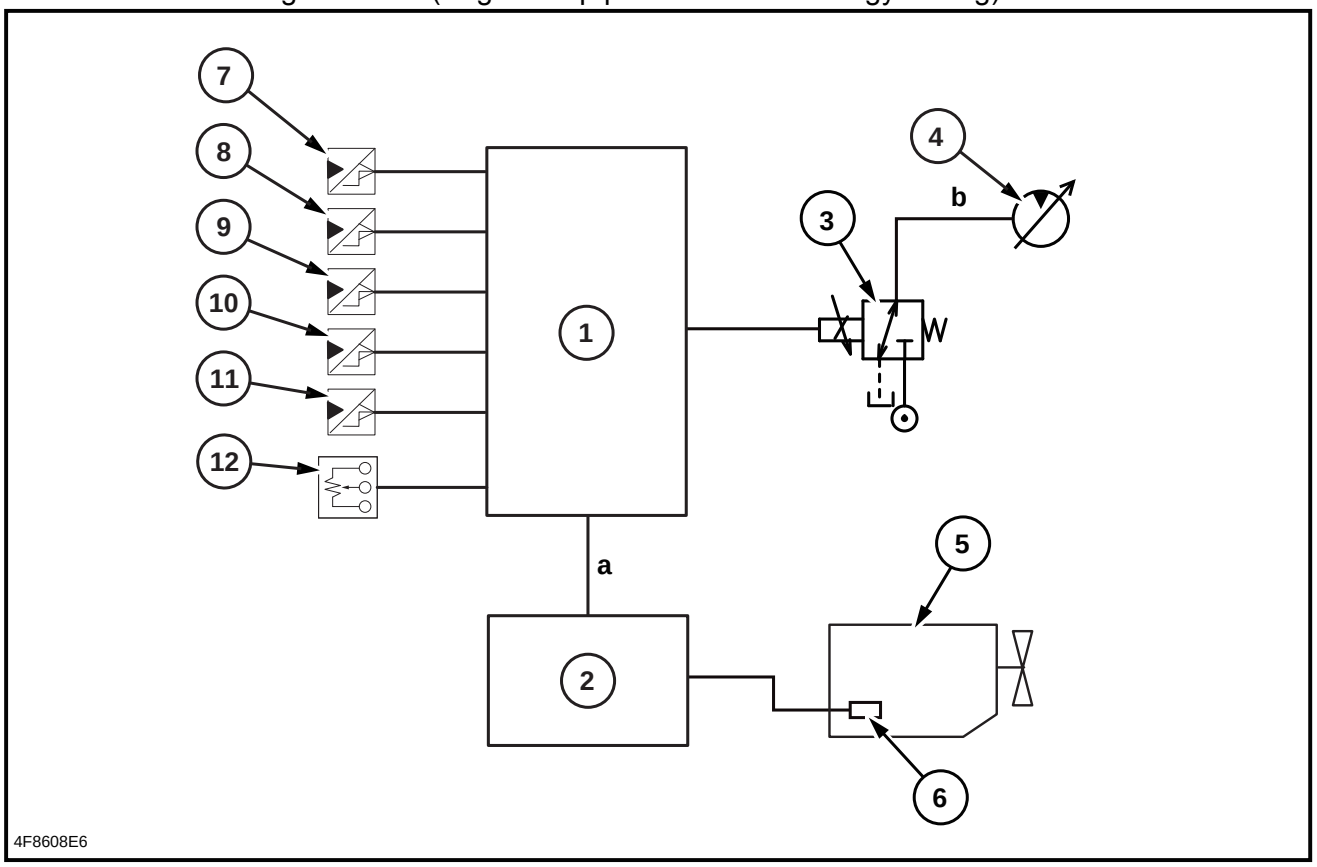
Filtering time = 32 sec
Oil temperature measurement cycle = 1 sec

- Pointer needle type: The system reads oil temperature immediately after the key is turned ON, and then instantly judges display level to display it on the monitor.
  Therefore, this enables confirming remaining oil temperature without waiting for filtering time due to preventing flickering.
- Operation at failure: The gauge level indicates zero at failure. It displays original monitor after resuming from failure status.

## Static Horsepower Control

<Purpose/Overview>

The system allows the pump to absorb the maximum engine horsepower by the pump (as much as not to cause stall) by controlling horsepower absorbed by the hydraulic pump in accordance with amount of engine down. (Engine stop prevention and energy-saving)




| | |
|---|---|
| a | Target RPM to the engine |
| b | Discharge volume increase/decrease |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Main controller | 5 | Engine | 9 | Pressure sensor (travel) |
| 2 | ECM | 6 | Crank position sensor | 10 | Pressure sensor (option 1) |
| 3 | Electromagnetic load proportional valve | 7 | Hydraulic pressure sensor (upper) | 11 | Pressure sensor (option 2) |
| 4 | Hydraulic pump | 8 | Hydraulic pressure sensor (swing) | 12 | Throttle volume |

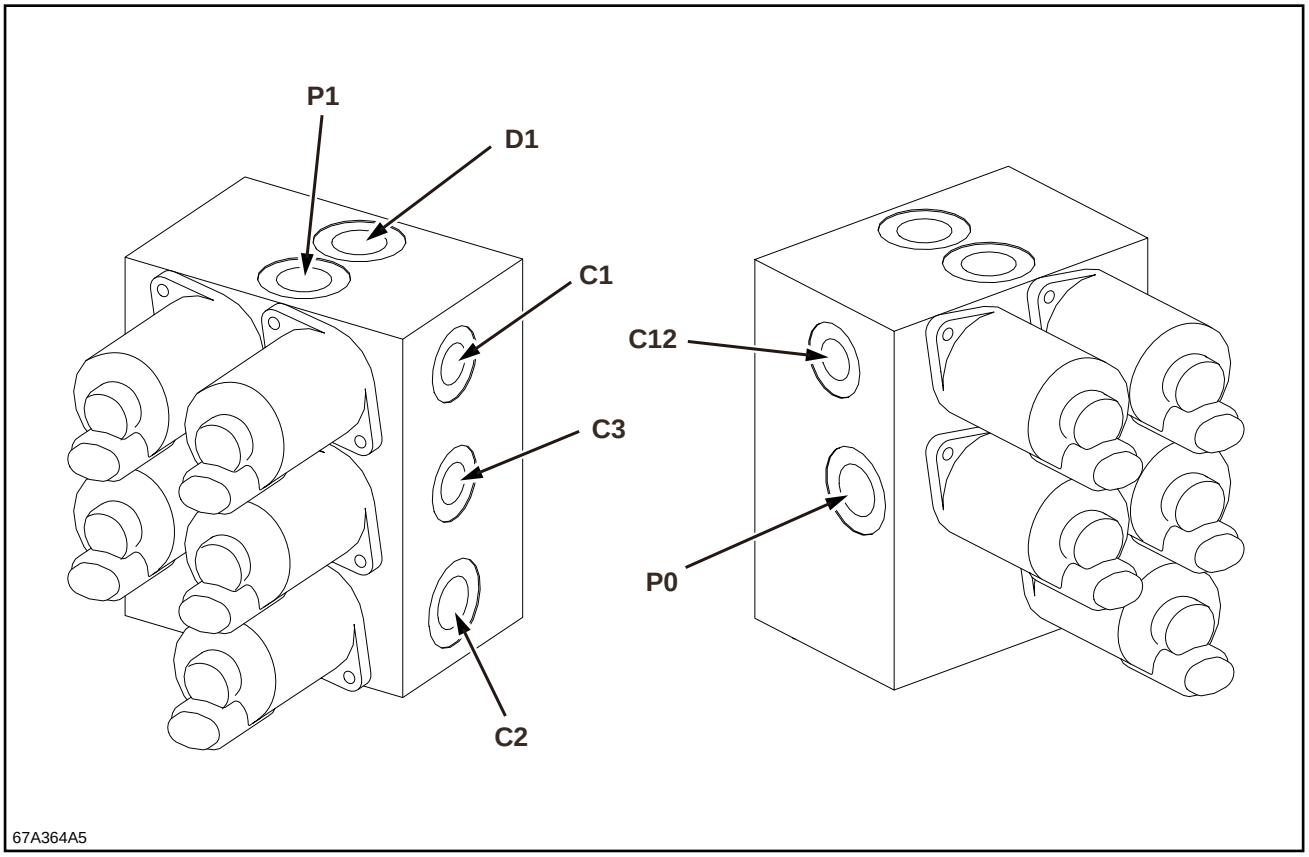
<Control>

Operation:

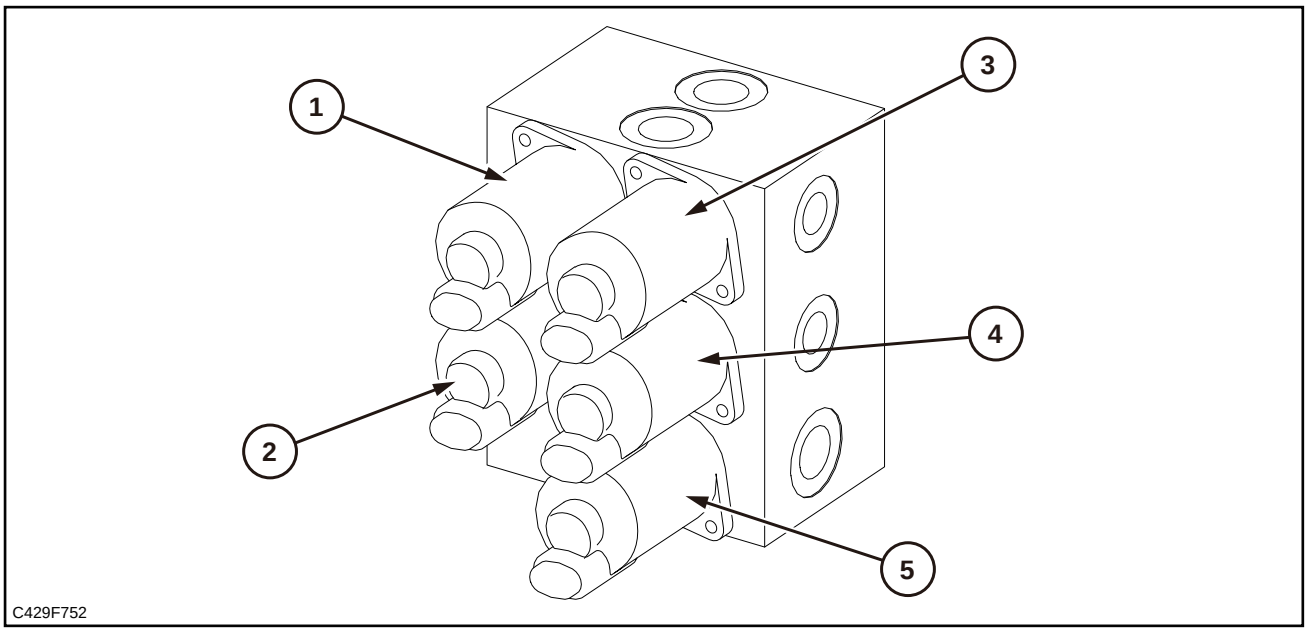
[1] The system gradually decreases pump horsepower to the lower limit based on judgment that absorbing horsepower of the hydraulic pump exceeds output horsepower of the engine when an amount of engine down becomes 30 $min^{-1}$ or more due to a load on the engine by the manipulation of the lever.

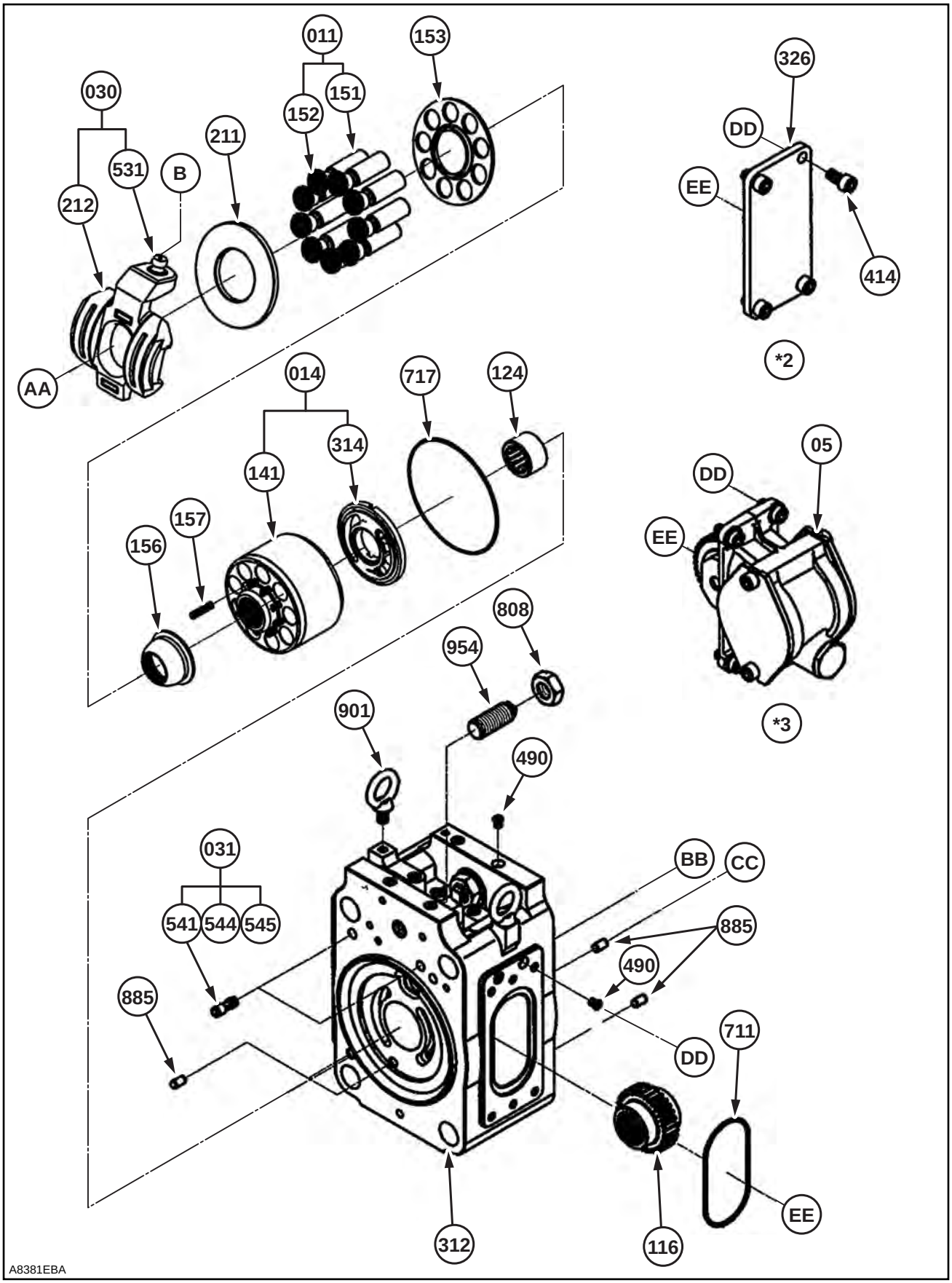
[2] It gradually increases the pump horsepower when amount of down becomes less than 30 $min^{-1}$ due to recovery of the engine.

## 5 Stack Solenoid Valve




| Port | Port size |
|---|---|
| C1 | G1/4 |
| C2 | G3/8 |
| C3 | G1/4 |
| C12 | G1/4 |
| D1 | G3/8 |
| P0 | G3/8 |
| P1 | G3/8 |

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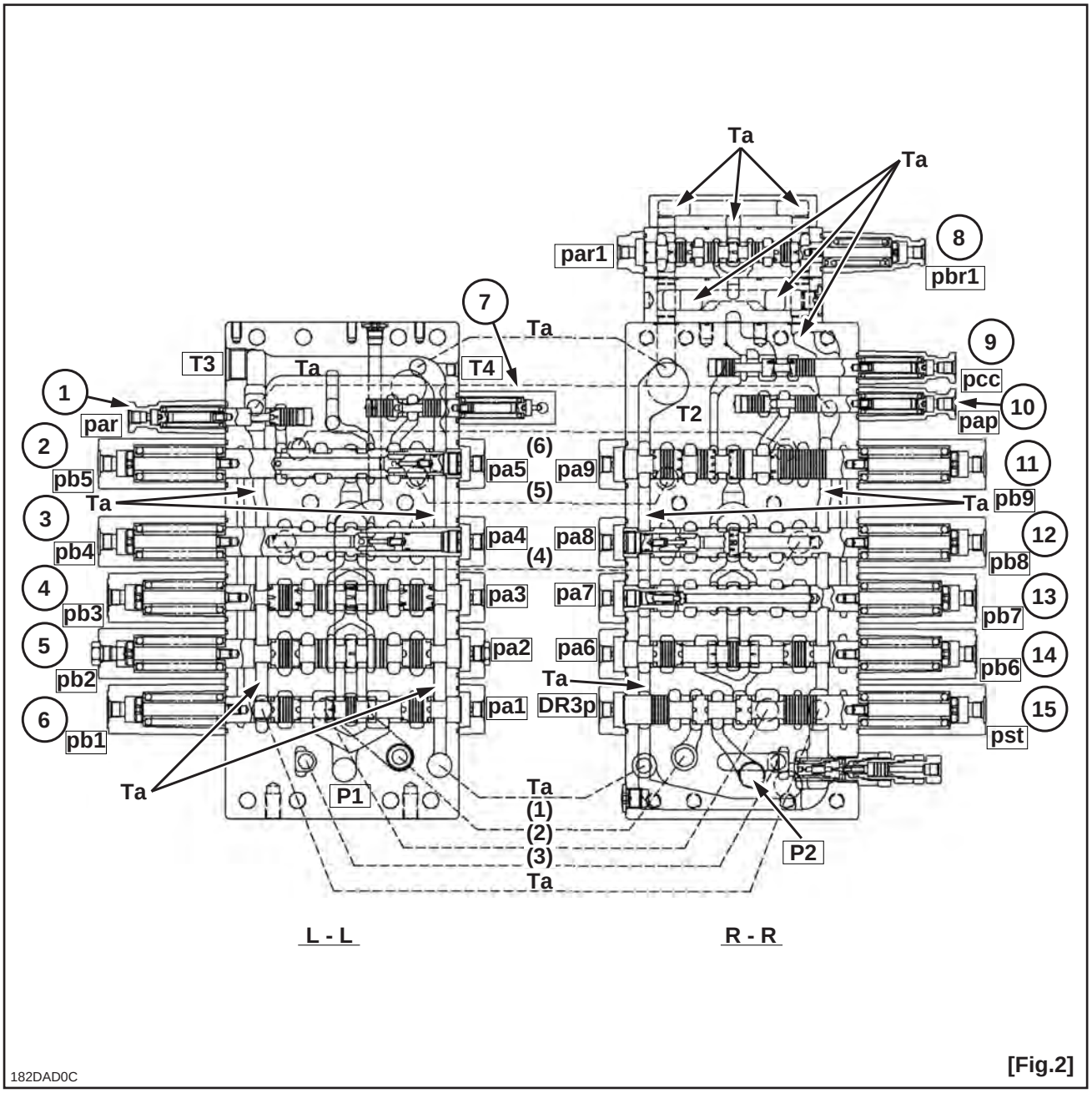
541
544
545
885
490
885
711
DD
EE
312
116
A8381EBA

| | | | |
|---|---|---|---|
| 1 | Low-pressure relief valve (L) | 9 | Inlet |
| 2 | Arm 1 (section 5) | 10 | Low-pressure relief valve (R) |
| 3 | Boom 2 (section 4) | 11 | Arm 2 (section 9) |
| 4 | Swing (section 3) | 12 | Boom 1 (section 8) |
| 5 | Option (section 2) | 13 | Bucket (section 7) |
| 6 | Travel (section 1) | 14 | Travel (section 6) |
| 7 | Outlet | 15 | Travel straight (section ST) |
| 8 | Attachment 1 (section R1) | | |




| | | | |
|---|---|---|---|
| 1 | Arm regeneration release | 9 | Neutral cut |
| 2 | Arm 1 (section 5) out/in | 10 | Arm 2 semi-parallel |
| 3 | Boom 2 (section 4) up/down | 11 | Arm 2 (section 9) in/out |
| 4 | Swing (section 3) | 12 | Boom 1 (section 8) down/up |
| 5 | Option (section 2) | 13 | Bucket (section 7) close/open |
| 6 | Travel (section 1) | 14 | Travel (section 6) |
| 7 | Arm 1 semi-parallel | 15 | Travel straight (section ST) |
| 8 | Attachment 1 (section R1) | | |

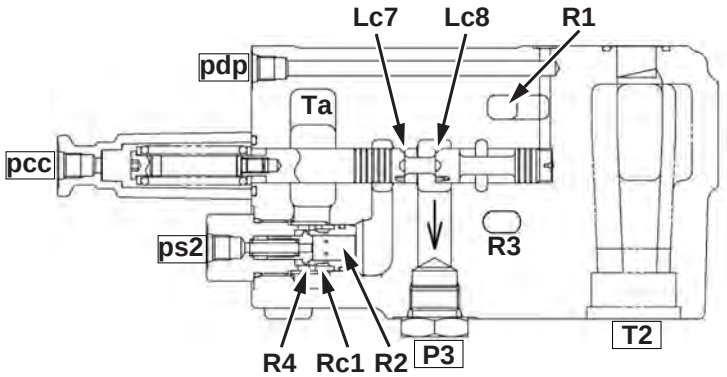
・ Pressure in the spring chamber d becomes drain pressure to activate the main poppet 1.

5. Neutral cut spool

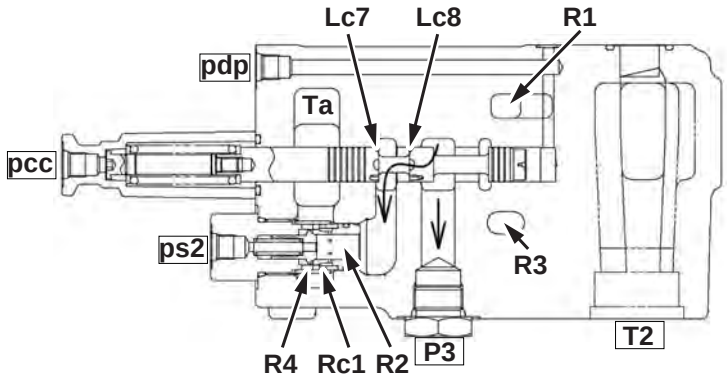
This valve is equipped with the neutral cut spool at the lowest down stream of the neutral path (R1) of the P2 side housing as a standard equipment.

Switching the neutral cut spool by pressurizing the pcc port cuts-off a path connected to the low pressure relief via the orifice (Lc7) to enable external output from the P3 port. [Fig. 23]

Switching the neutral cut spool by pressurizing the pdp port enables dividing flow to direction of the low pressure relief by the orifice (Lc8). [Fig. 24]




9B49DE47 [Fig.23]




DF0939C6 [Fig.24]

6. Add-on [Fig. 25, 26]

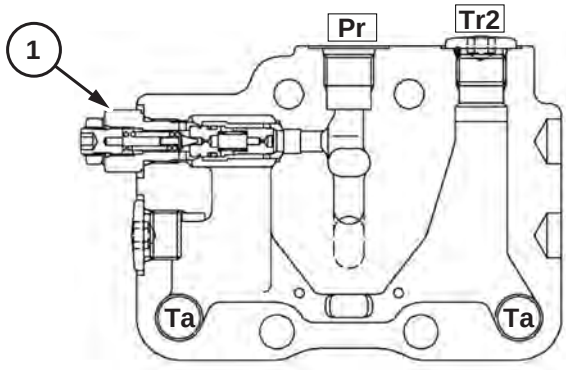
[1] Main relief valve for add-on [Fig. 25]

Oil fed from the Pr port is led to the main relief valve for add-on. Activation of the relief valve regulates the maximum pressure of the Pr pump.

[2] Spool section [Fig. 26]

The neutral path (Pg) closes when the spool is switched by pressurizing it from the pilot port par1 (pbr1) of the add-on (section 10). Oil fed from the Pg port flows to the AR1 (BR1) port via the load check valve (S10-1), path (S10-2) and neck of the spool from the parallel path (Rg).

Returning oil returns to the tank path (Ta) via neck of the spool from the BR1 (AR1) port.

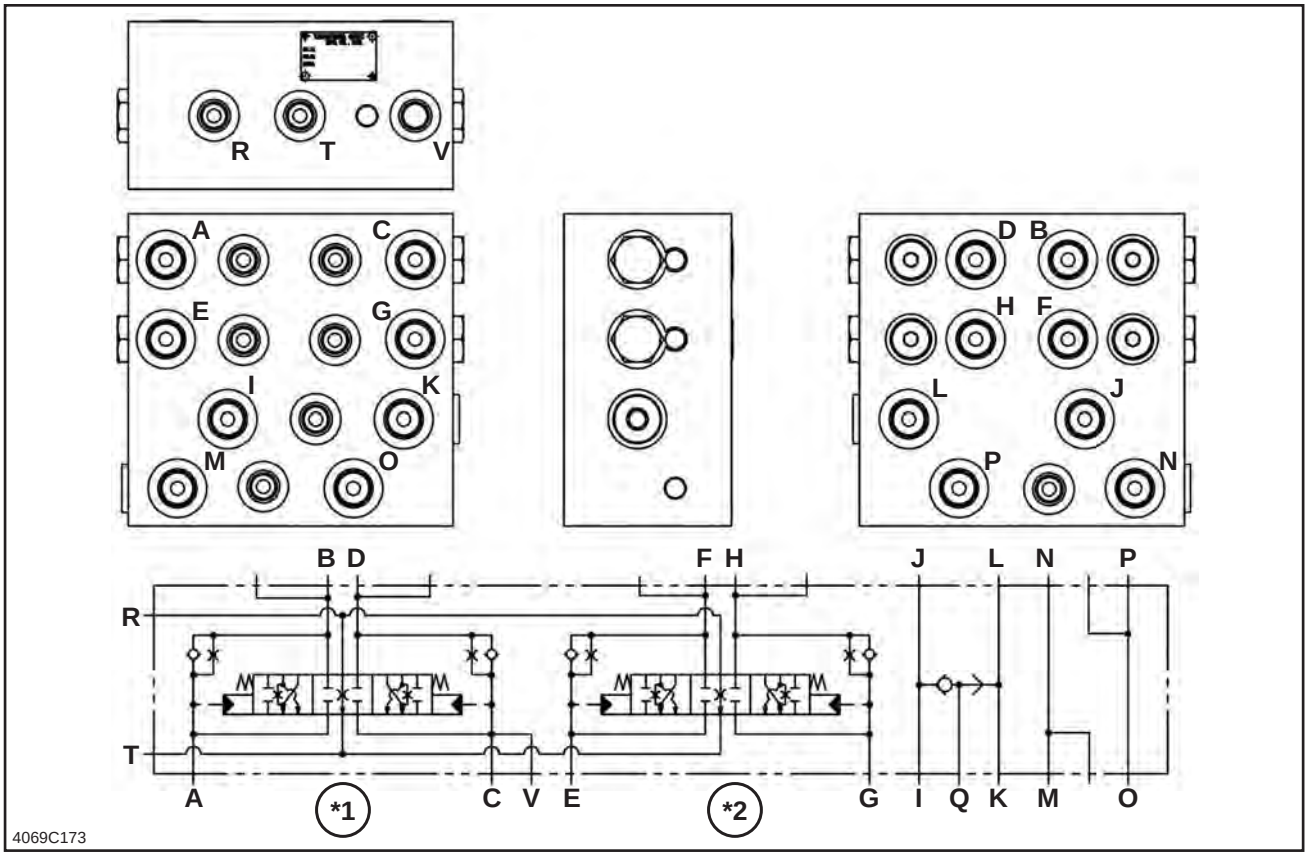



E6498142 [Fig.25]

## Cushion Valve

### structure

This valve consists of the cushion valve with heat circuit section and the shuttle valve section.
The cushion valve with heat circuit, which connects between the control valve and the pilot operation valve of the hydraulic excavator, reduces the shaking of the vehicle due to operator's sudden stop operation (cushion function).
This valve also has a circuit that disables the cushion function during reverse operation by the operator's intention.
The shuttle valve chooses a higher signal pressure from two lines of signal pressures.
This valve has one circuit.

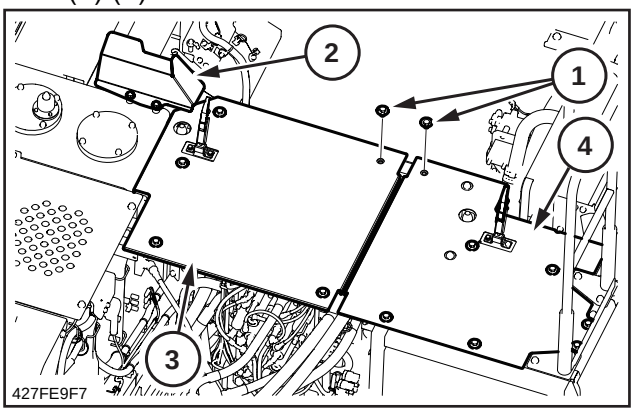



| | |
|---|---|
| *1 | Arm |
| *2 | Boom |

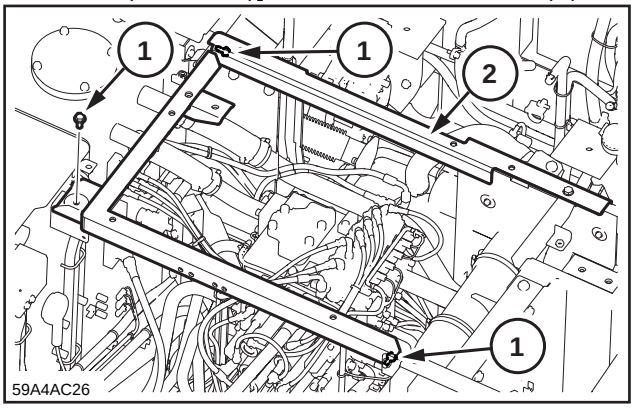
### operation explanation

1. During normal operation
   The pressure oil supplied from the pilot operation valve to the port A (or the port C, E, G) pushes up the check plunger, and is sent to the port B (or the port D, F, H).
   The pressure oil that has passed through the port B acts on the spool of the control valve to operate the actuator.
   The oil pushed out of the spool of the control valve passes through the port D (or the port B, F, H), and flows into the port T.

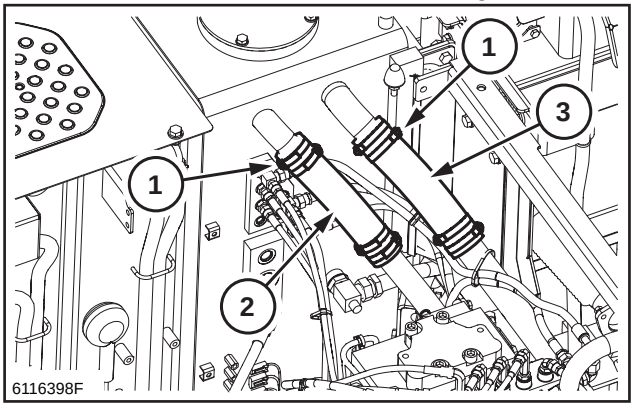
6. Remove the 14 bolts (1) with a wrench [19 mm (0.748 in.)] to remove the covers (2) (3) (4).



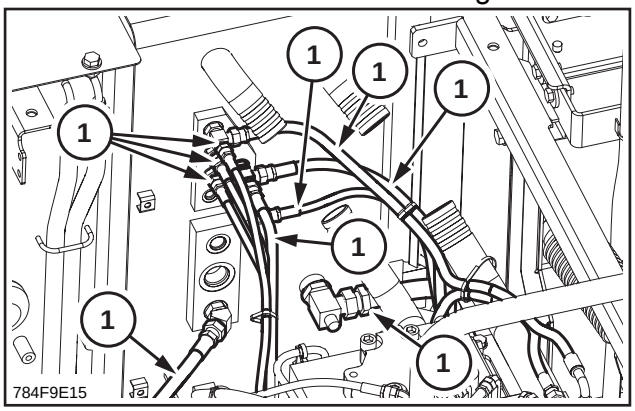

7. Remove the 3 bolts (1) with a wrench [19 mm (0.748 in.)] to remove the frame (2).



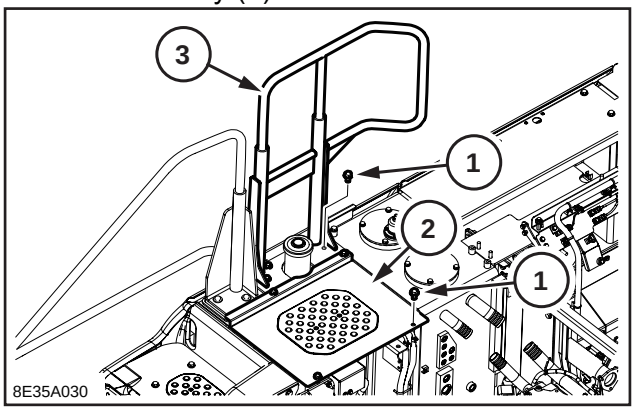

8. Loosen the 4 hose clamps (1) with a wrench [7 mm (0.276 in.)] to remove the hydraulic hose (2) (3).
   - Apply marking at each location of the hydraulic reservoir and the hose so as to match connections at assembling.
   - Attach caps and plugs at each location of the hydraulic reservoir and hose so as to prevent invasion of water, dust and dirt.
   - Wash each location of the hydraulic reservoir and the hoses by blowing parts cleaner so as to prevent adhering dirt at connections and not to damage them.



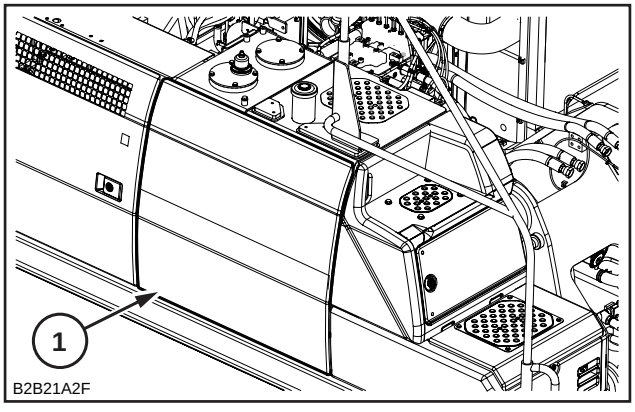

9. Remove the 9 hydraulic hoses (1) from the hydraulic tank.
   - Apply marking at each location of the hydraulic reservoir and the hose so as to match connections at assembling.
   - Attach caps and plugs at each location of the hydraulic reservoir and hose so as to prevent invasion of water, dust and dirt.
   - Wash each location of the hydraulic reservoir and the hoses by blowing parts cleaner so as to prevent adhering dirt at connections and not to damage them.



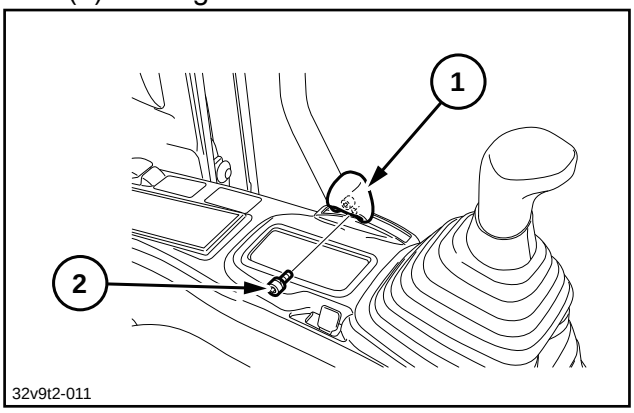

10. Remove the 9 bolts (1) with a wrench [19 mm (0.748 in.)] to remove the cover (2) and the stay (3).



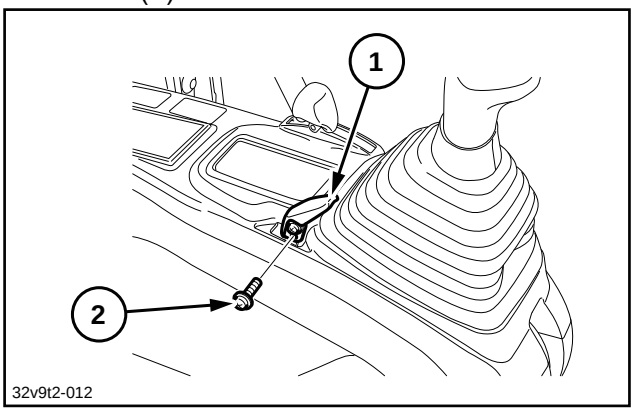

11. Remove the side cover (1). (Refer to the "Removal and Installation of Fuel Tank" for detail.)



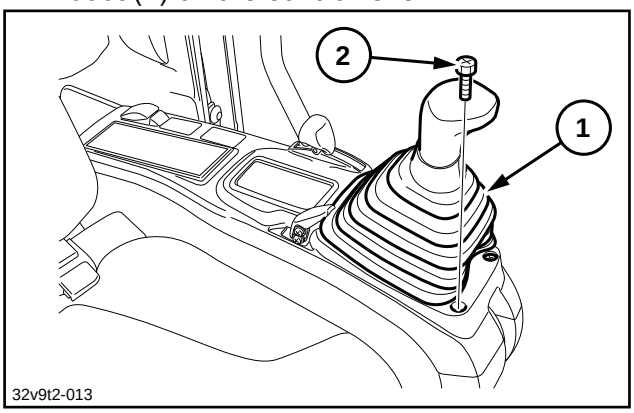
11. Tighten the 2 bolts (2) with a hexagon wrench [5 mm (0.197 in.)] to mount the grip (1) of the gate lock lever.




12. Tighten the 2 screw (2) with a Phillips screwdriver to mount the handle of the tilt lever (1).

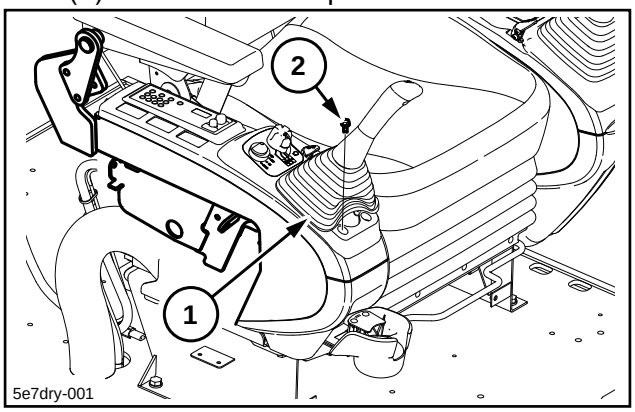



13. Tighten the 2 bolts (2) of the console top cover with a Phillips screwdriver or a box wrench [10 mm (0.394 in.)], and put the boot (1) on the control lever.

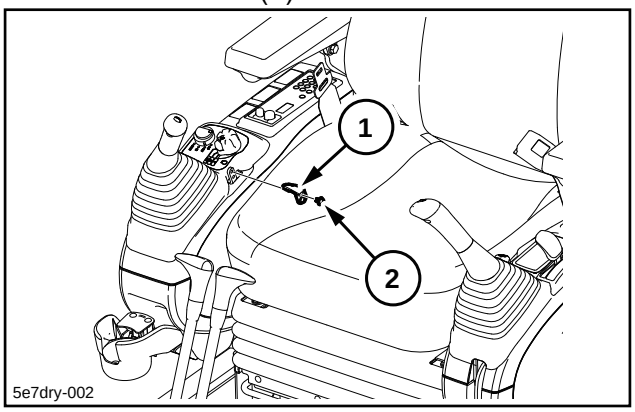



## Removal of Operation Remote Control Valve (right side)

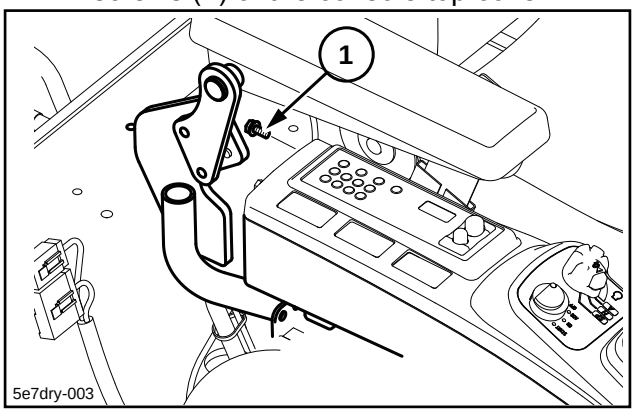
1. Roll up the boot (1) of the control lever and use the Phillips screwdriver or box wrench [ 10 mm ( 0.394 in. ) ] to remove the 2 bolts (2) of the console top cover.




2. Use the Phillips screwdriver to remove the 2 screws (2), and then remove the handle of the tilt lever (1).




3. Use the Phillips screwdriver to remove the 2 screws (1) of the console top cover.

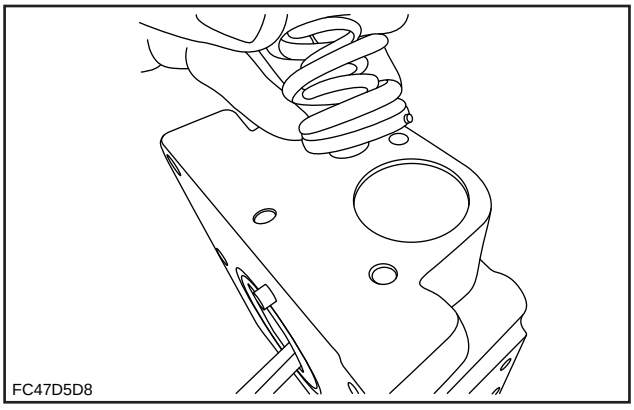


## Component Table

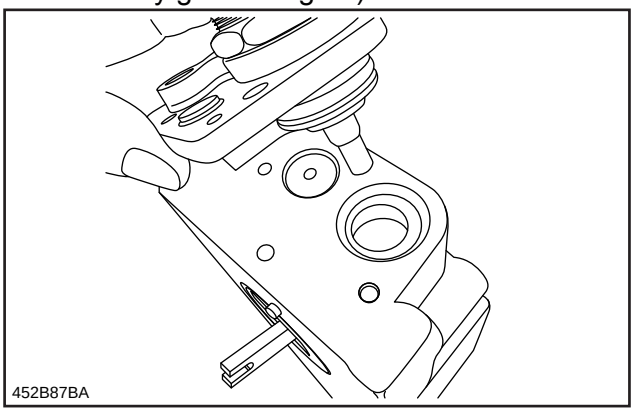
| | |
|---|---|
| *1 | Valve plate for right rotation |
| *2 | Without PTO |
| *3 | With PTO |
| *4 | Valve plate for left rotation |

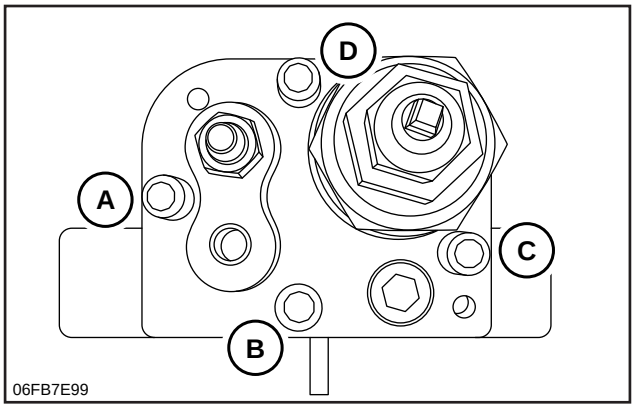
| Code | Part name | Quantity | Component number (quantity) or format |
|---|---|---|---|
| 04 | Gear Pump | 1 set | ZX10LARZ1-07A-V |
| 05 | PTO unit | 1 set | |
| 011 | piston subassembly | 2 sets | 151 (9 pc), 152 (9 pc) |
| 013 | Cylinder subassembly (R) | 1 set | 141 (1 pc), 313 (1 pc) |
| 014 | Cylinder subassembly (L) | 1 set | 141 (1 pc), 314 (1 pc) |
| 030 | Swash plate subassembly | 2 sets | 212 (1 pc), 531 (1 pc) |
| 031 | Check valve 4 subassembly | 4 sets | 541 (1 pc), 544 (1 pc), 545 (1 pc) |
| 530 | Servo piston subassembly | 2 sets | 214 (1 pc), 532 (1 pc), 548 (1 pc) |

| Code | Part name | Quantity | Code | Part name | Quantity |
|---|---|---|---|---|---|
| 111 | Drive shaft (F) | 1 | 534 | Stopper (L) | 2 |
| 113 | Drive shaft (R) | 1 | 535 | Stopper (S) | 2 |
| 116 | 1st gear | 1 | 537 | Servo cover | 2 |
| 123 | cylinder roller bearing | 2 | 541 | seat | 4 |
| 124 | Needle pin roller bearing | 2 | 544 | Stopper 1 | 4 |
| 127 | Bearing spacer | 3 | 545 | Steel ball | 4 |
| 141 | Cylinder block | 2 | 548 | feedback pin | 2 |
| 151 | Piston | 18 | 702 | O-ring | 2 |
| 152 | Shoe | 18 | 710 | O-ring | 1 |
| 153 | holder plate | 2 | 711 | O-ring | 1 |
| 156 | spherical bushing | 2 | 717 | O-ring | 2 |
| 157 | cylinder spring | 18 | 723 | O-ring | 14 |
| 211 | shoe plate | 2 | 724 | Square ring | 10 |
| 212 | swash plate | 2 | 726 | O-ring | 4 |
| 214 | Tilting bushing | 2 | 728 | O-ring | 4 |
| 251 | swash plate support board | 2 | 732 | O-ring | 2 |
| 261 | Seal cover (F) | 1 | 774 | oil seal | 1 |
| 271 | Pump casing (F) | 1 | 789 | Backup ring | 2 |
| 272 | Pump casing (R) | 1 | 792 | Backup ring | 2 |
| 312 | Valve block B | 1 | 806 | Hexagon nut | 2 |
| 313 | Valve plate (R) | 1 | 808 | Hexagon nut | 2 |
| 314 | Valve plate (L) | 1 | 824 | Stop ring | 3 |
| 401 | Hexagon socket head bolt | 4 | 885 | Pin | 4 |
| 406 | Hexagon socket head bolt | 4 | 886 | Pin | 2 |
| 419 | Hexagon socket head bolt | 4 | 901 | eyebolt | 2 |
| 466 | ROH plug | 2 | 953 | Hexagon socket head set screw | 2 |
| 468 | ROH plug | 4 | 954 | Set screw | 2 |
| 490 | Plug | 18 | 981 | Nameplate | 1 |
| 531 | tilting pin | 2 | 983 | Striking steel | 2 |
| 532 | servo piston | 2 | | | |

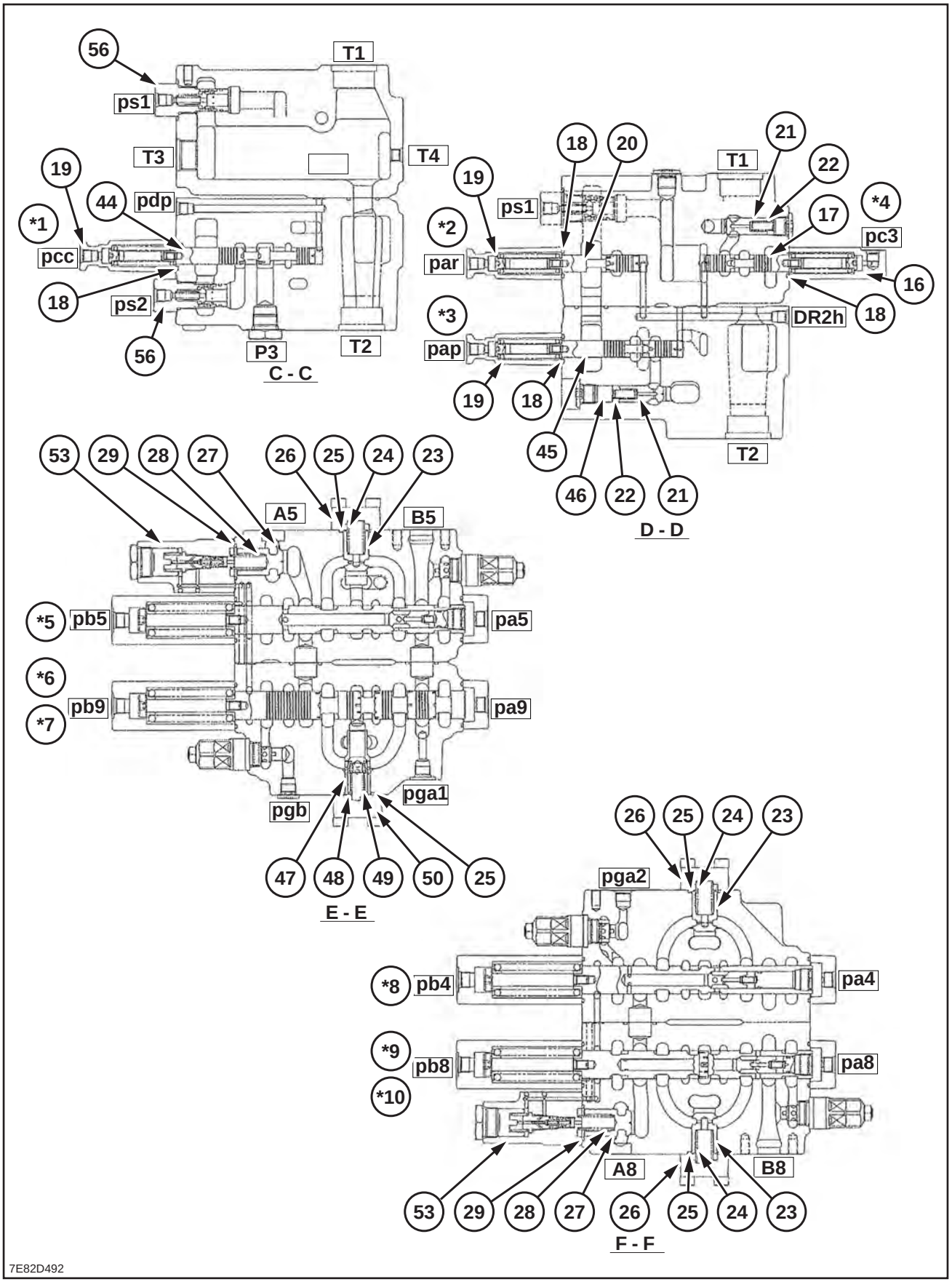



8. Insert the adjusting ring (Q) (645) and attach the cover (C)(629), of which the adjusting screw (C) (628), the adjusting ring (C) (627), the lock nut (630), the hexagonal nuts (801, 802), and the hexagon socket head retaining screw (924) are set.
   - When tightening the mounting bolt (436) of the cover (C) (629), tighten the C and D bolts alternately little by little first.
     After fully tightening the C and D bolts, tighten the A and B mounting bolts. (* The reaction force of the outer spring (625) is strong. Therefore, the cover (C) (629) may fall over, and the casing (601) and the adjusting screw (C) (628) may get damaged.)



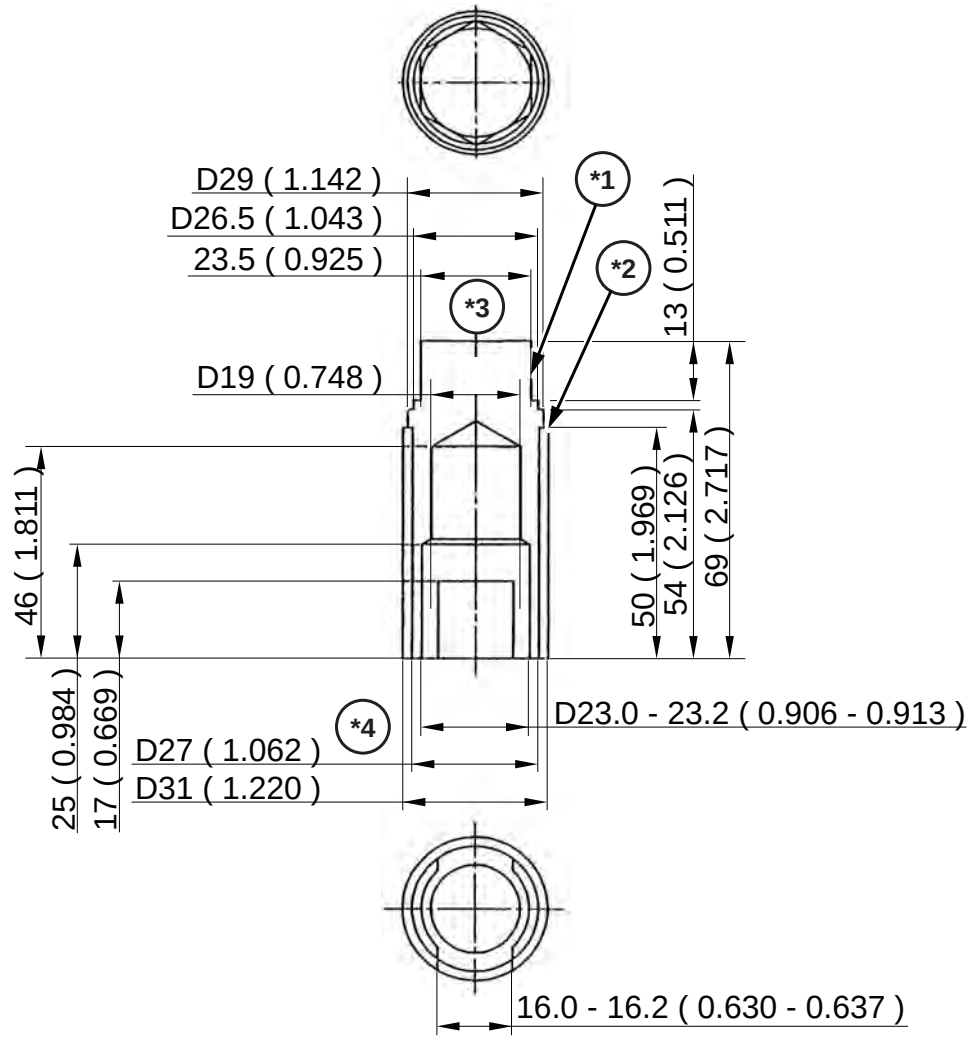

9. Insert the spring (666) and the spool (665) to the valve casing (660). Then tighten the ROH plug (466).
   - The spool (665) has the specific insertion direction. Pay attention not to incorrectly insert the spool.
10. Attach the electromagnetic proportional pressure reducing valve (079) to the valve casing (660). Then, attach the valve casing (660) to the casing (601).
    Now, the regulator assembly completes.




| | | | | | |
|---|---|---|---|---|---|
| *1 | Neutral cut | *5 | Arm 1 | *9 | Up/down |
| *2 | Arm regeneration release | *6 | Out/in | *10 | Boom 1 |
| *3 | Arm 2 semi-parallel | *7 | Arm 2 | | |
| *4 | Arm 1 semi-parallel | *8 | Boom 2 | | |

| Tightening torque | | |
|---|---|---|
| Code | Screw size | Tightening torque |
| 301 | M14 | 44.2 - 50.0 N·m<br>( 32.61 - 36.88 lbf・ft. ) |
| 302<br>312 | M14 | 63.7 - 73.5 N·m<br>( 46.99 - 54.22 lbf・ft. ) |

**mm ( in. )**

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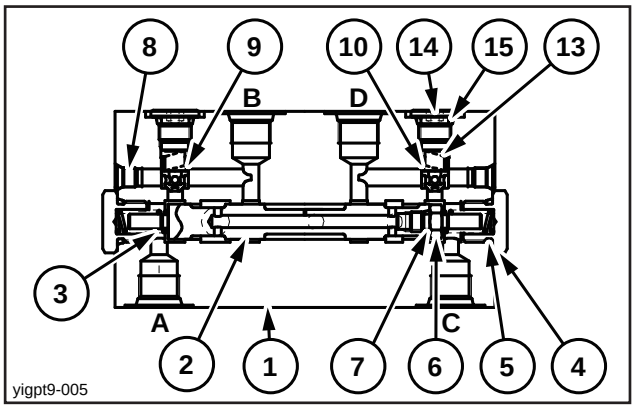
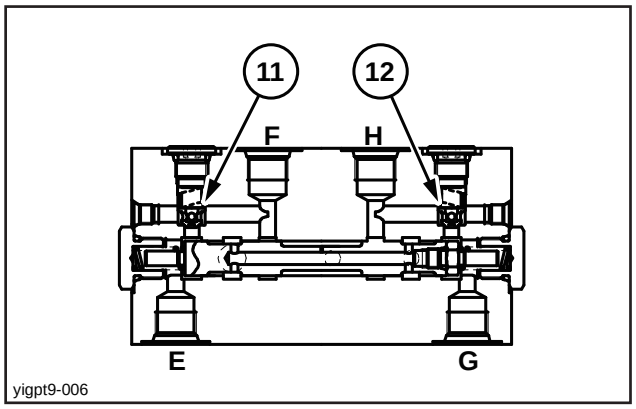
Detailed diagram of jig main unit
(1) and (2) are inserted by tightening.
Attached diagram 2. Jig main unit

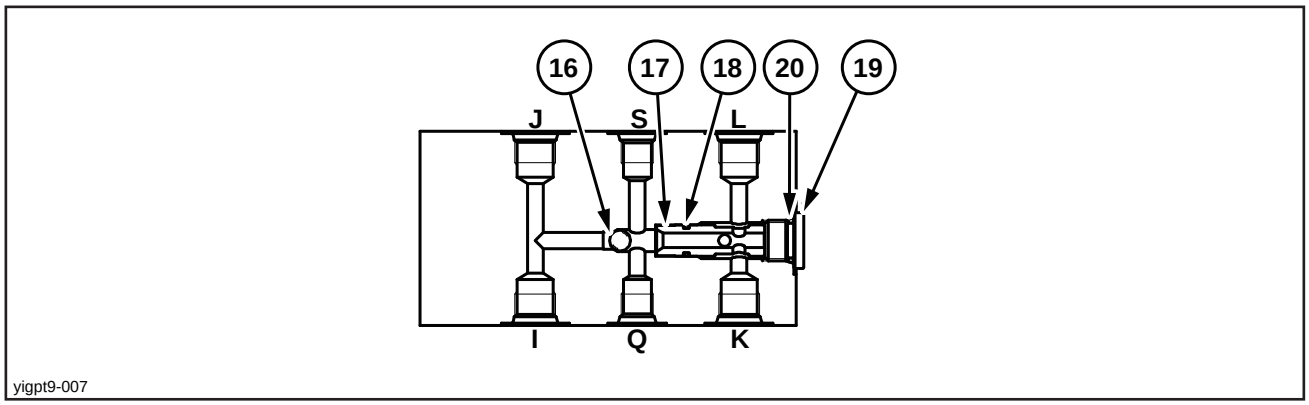
| | | | |
|---|---|---|---|
| *1 | (1) Material: SCM415 (N) carburized | *3 | (Bolt width) |
| *2 | (2) Material: S45C | *4 | Hole H6 + 0.13<br>Shaft n6 + 0.028 |




Cross section X-




Cross section Y-

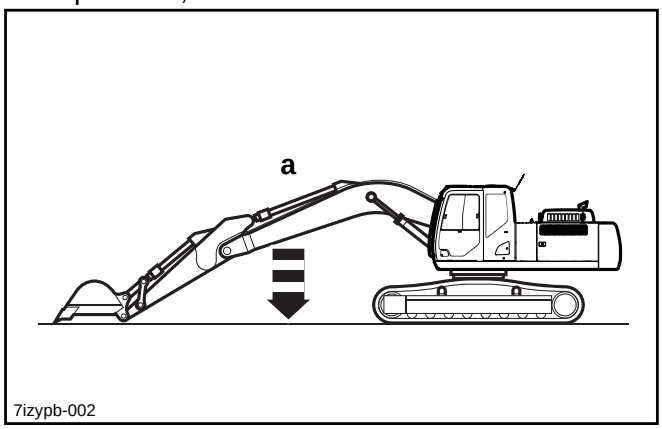



Cross section V-
Cross-section diagram

| Code | Part name | Code | Part name | Code | Part name |
|---|---|---|---|---|---|
| 1 | Body | 9 | Check plunger | 17 | Seat |
| 2 | Spool | 10 | Check plunger | 18 | O-ring |
| 3 | Spring | 11 | Check plunger | 19 | Plug |
| 4 | Plug | 12 | Check plunger | 20 | O-ring |
| 5 | O-ring | 13 | Spring | 21 | Name plate |
| 6 | Cap screw | 14 | Plug | 22 | Drive screw |
| 7 | O-ring | 15 | O-ring | 23 | Plug |
| 8 | Plug | 16 | Steel ball | 24 | Plug |

■Boom-down pressure measurement

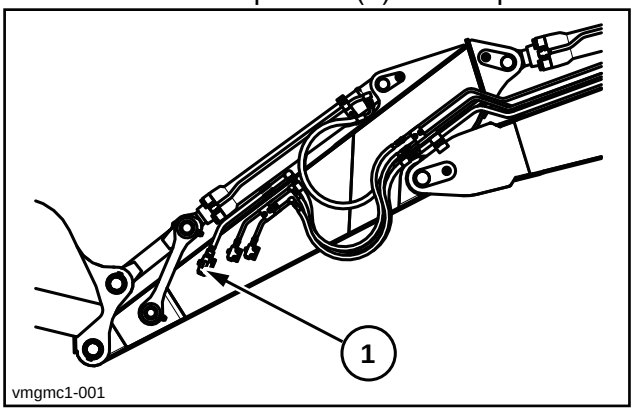
For pressure measurement with the boom down, put the arm cylinder at its out stroke end, open the bucket, put the bucket tip on the ground, carry out the boom-down operation, and measure.




| | |
|---|---|
| a | Boom-down relief |

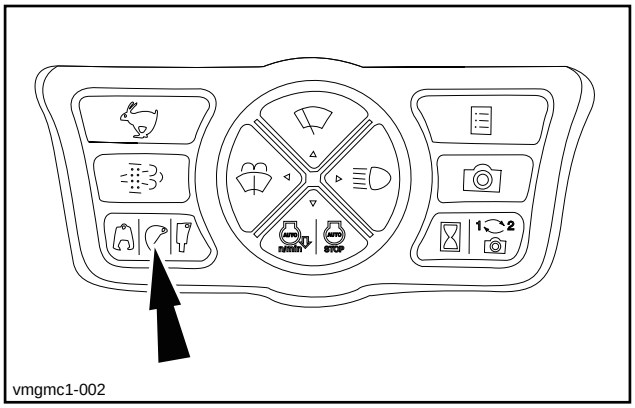
D. Option Line Pressure Measurement

1. Close the stop valve (1) of the option line.




2. Change the attachment select switch on the monitor to the option line to be measured. (Breaker/crusher)
3. Perform measurement according to the following operation.

| | |
|---|---|
| Engine speed | 2000 $min^{-1}$ (2000 rpm) |
| Work mode | SP mode |
| Pedal operation | Option relief |
| Oil temperature | 45 (113.0) - 55 °C (131.0 °F) |
| Measuring port | 1 pumps: P1 port |
| | 2 pump: P2 port |

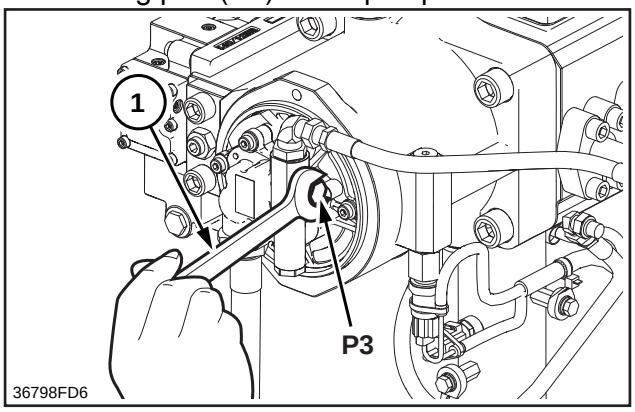



* Adjust the set pressure according to the specification of the attachment used.

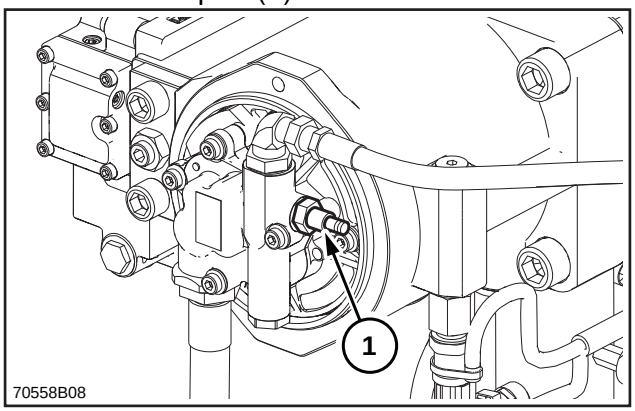
## Pilot Pressure Measurement

Pressure Gauge Installation

Remove the plug using the wrench (1) in order to install a pressure gauge to the pressure measuring port (P3) of the pump.



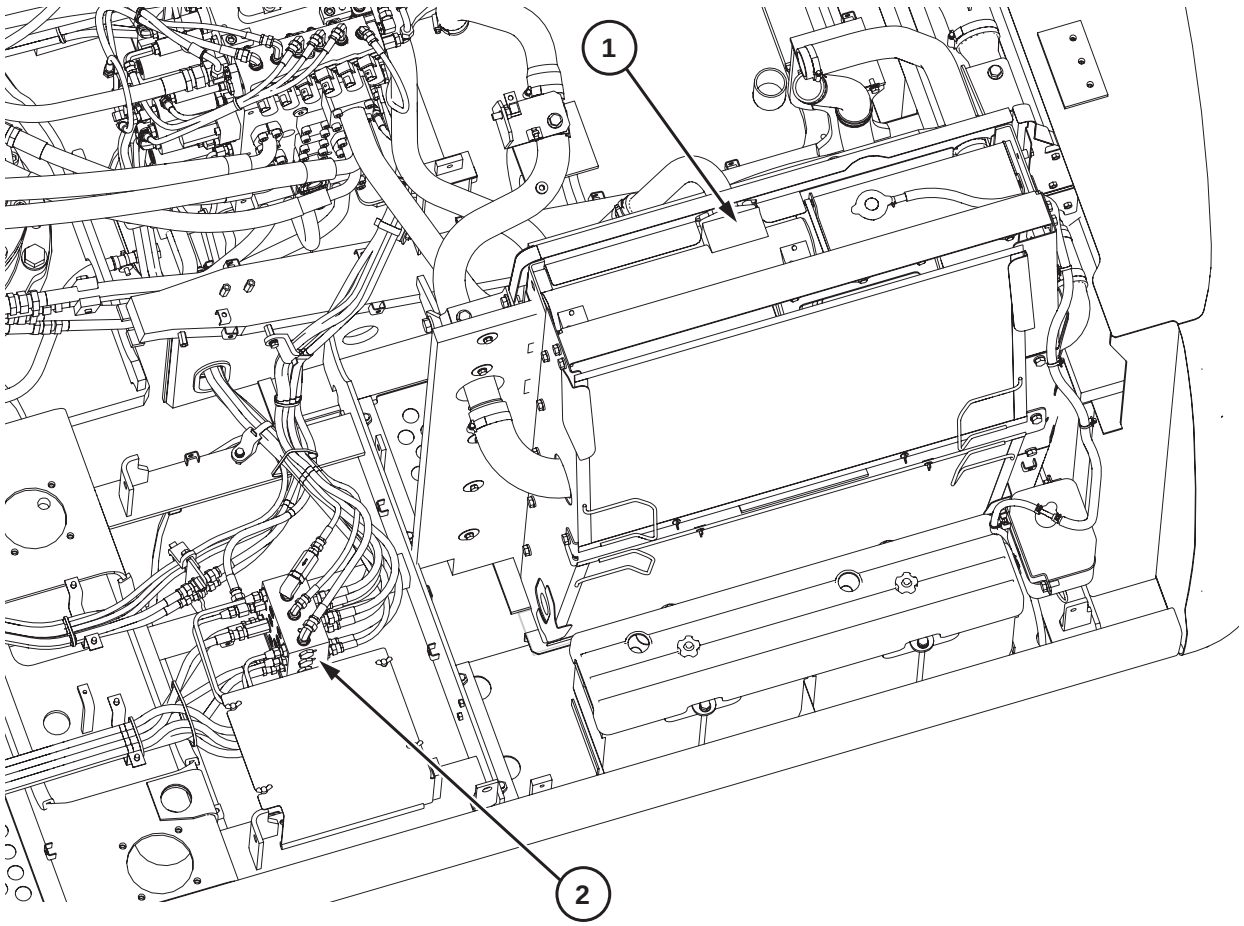

Install the adapter (1).

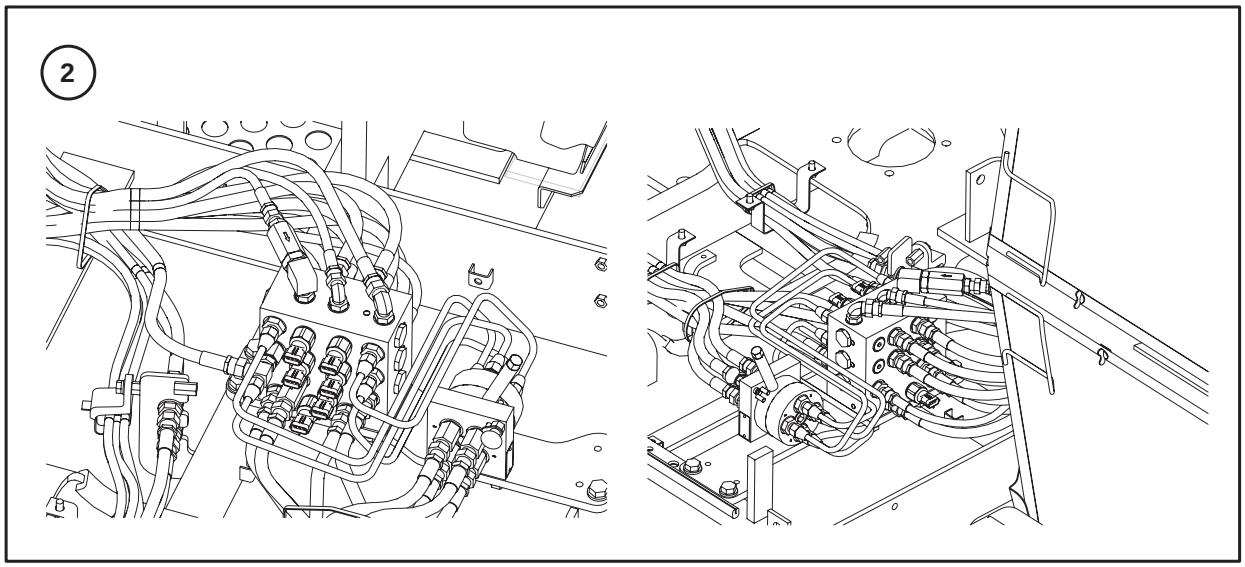



Install the pressure gauge (1) to measure the pressure.

| | |
|---|---|
| Engine speed | 2000 $min^{-1}$ (2000 rpm) |
| Work mode | SP mode |
| Oil temperature | 45 - 55 °C (113.0 - 131.0 °F) |
| Measuring port | P3 port |
| Set pressure | 3.92 MPa (568.61 psi) |

## Housing Left Side Hydraulic Equipment Layout

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| | |
|---|---|
| 1 | Oil cooler |
| 2 | Cushion valve (with heat circuit) |

# R. ELECTRICAL PARTS

■Maintenance Information Screen Lock

<Summary>
The maintenance information screen has a function that allows the car-rental agency to lock this screen when renting the system to the customers so that they may view but not change the settings on the screen (remaining time and replacement interval).
For the setting procedure, refer to SERVICE SUPPORT SCREEN-SET UP-PERAMETERS.

<Control>

- When it is locked, a cursor movement is limited to the title line. (Choosing the maintenance information screen tab is allowed.)
- The customers are allowed to turn the pages to view the remaining time. However, they are no longer allowed to reset the remaining time or change the replacement interval.

■Option Line Setting Screen Lock

<Summary>
The option line setting screen has a function that allows the car-rental agency to lock this screen when renting the system to the customers so that they may view but not change the settings on the screen (flow setting and pressure setting).
For the setting procedure, refer to SERVICE SUPPORT SCREEN-SET UP-PERAMETERS.

<Control>

- When it is locked, a cursor movement is limited to the ATT number selection line. (Choosing the option line setting screen tab is allowed. Selecting an ATT type or selecting an ATT number is also allowed.)
- The customers are allowed to change the ATT type selection or the ATT number selection and view the current settings. However, they are not allowed to change them.



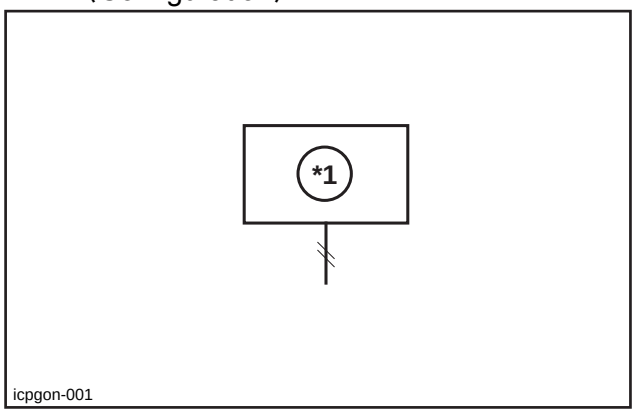
## Setting

Clock Adjustment

〈Summary〉
Adjust the clock that is displayed on the monitor.

- Refer to the page for information on the clock.

〈Configuration〉




| | |
|---|---|
| *1 | Color monitor |

〈Operation explanation〉

[1] The system will display "--:--" on the monitor when the key is turned to the ON position.

[2] The operator sets the time using the "Time Adjustment" function on the menu screen.
Move the cursor left to right, and change the time by moving up and down, and press the menu switch to confirm the values.

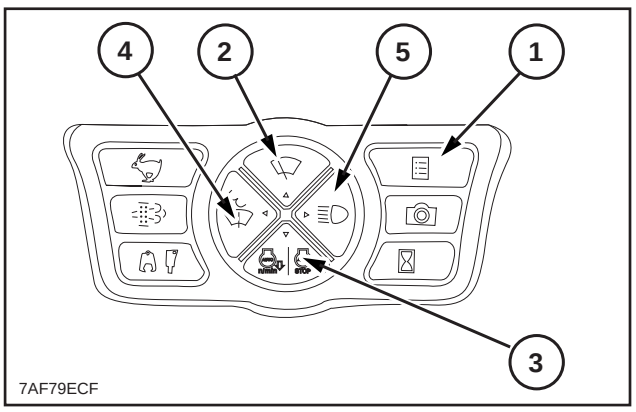
[3] The system displays the time on the monitor.

- The clock data is stored in the monitor, so the time data remains stored even if the sub-controller is replaced.

If the monitor is replaced, the time must be set again.

How to adjust the clock

1. Press button (1) to display the menu screen.




2. Press button (2) or (3) and select "Clock Adjustment" on the menu screen.

| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| ARM2 CLOSE SSC P.SOL | Arm-2-in SSC proportional valve | mA | 0 | 1000 |
| ARM1 CLOSE REGEN. P.SOL | Arm 1 regeneration release proportional valve | mA | 0 | 1000 |
| ARM1 SEMI-PARA P.SOL | Arm 1 semi-parallel proportional valve | mA | 0 | 1000 |
| ARM2 SEMI-PARA P.SOL | Arm 2 semi-parallel proportional valve | mA | 0 | 1000 |
| POWER BOOST SOL | Pressure boost solenoid | on/off | ---- | ++++ |

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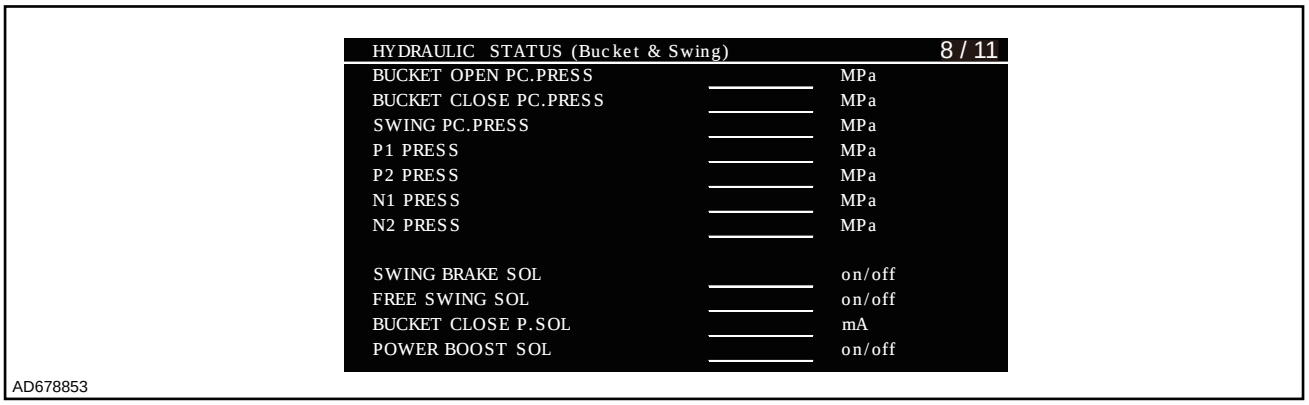


| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| BUCKET OPEN PC.PRESS | Bucket-open pilot pressure | MPa (psi) | 0 | 5 (725.1) |
| BUCKET CLOSE PC.PRESS | Bucket-close pilot pressure | MPa (psi) | 0 | 5 (725.1) |
| SWING PC.PRESS | Swing pilot pressure | MPa (psi) | 0 | 5 (725.1) |
| P1 PRESS | P1 pressure | MPa (psi) | 0 | 50 (7251) |
| P2 PRESS | P2 pressure | MPa (psi) | 0 | 50 (7251) |
| N1 PRESS | N1 pressure | MPa (psi) | 0 | 5 (725.1) |
| N2 PRESS | N2 pressure | MPa (psi) | 0 | 5 (725.1) |
| | | | | |
| SWING BRAKE SOL | Swing brake solenoid | on/off | ---- | ++++ |
| FREE SWING SOL | Free swing solenoid | on/off | ---- | ++++ |
| BUCKET CLOSE P.SOL | Bucket-close pilot pressure proportional valve | mA | 0 | 1000 |
| POWER BOOST SOL | Pressure boost solenoid | on/off | ---- | ++++ |

| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| N1 PRESS RANGE 5 | N1 pressure; time distribution 5 | hour | Less than 3.0 MPa | Engine in operation |
| N1 PRESS RANGE 6 | N1 pressure; time distribution 6 | hour | Less than 3.5 MPa | Engine in operation |
| N1 PRESS RANGE 7 | N1 pressure; time distribution 7 | hour | 3.5 MPa or more | Engine in operation |
| | | | | |
| N1 PRESS MAX | Maximum N1 pressure | MPa (psi) | - | Engine in operation |

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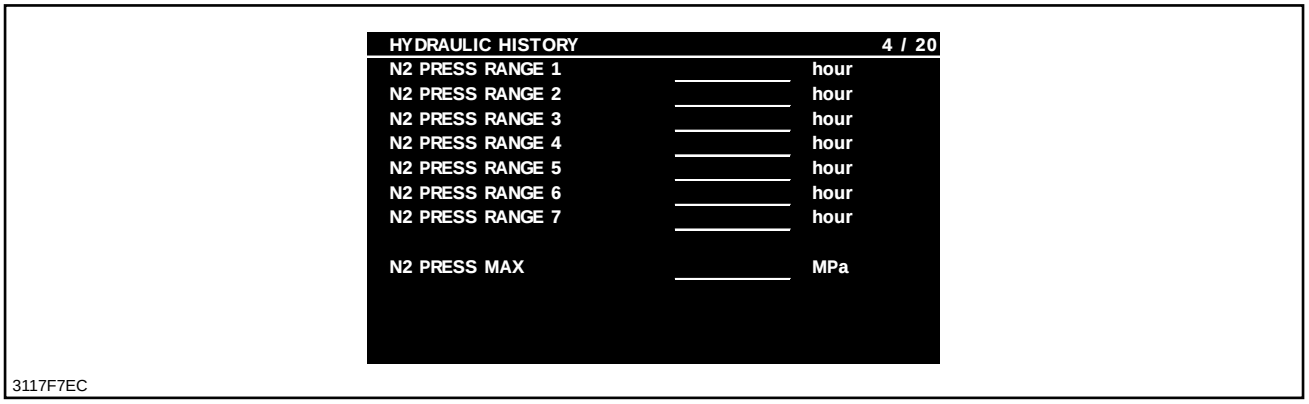


| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| N2 PRESS RANGE 1 | N2 pressure; time distribution 1 | hour | 1.0 MPa | Engine in operation |
| N2 PRESS RANGE 2 | N2 pressure; time distribution 2 | hour | Less than 1.5 MPa | Engine in operation |
| N2 PRESS RANGE 3 | N2 pressure; time distribution 3 | hour | Less than 2.0 MPa | Engine in operation |
| N2 PRESS RANGE 4 | N2 pressure; time distribution 4 | hour | Less than 2.5 MPa | Engine in operation |
| N2 PRESS RANGE 5 | N2 pressure; time distribution 5 | hour | Less than 3.0 MPa | Engine in operation |
| N2 PRESS RANGE 6 | N2 pressure; time distribution 6 | hour | Less than 3.5 MPa | Engine in operation |
| N2 PRESS RANGE 7 | N2 pressure; time distribution 7 | hour | 3.5 MPa or more | Engine in operation |
| | | | | |
| N2 PRESS MAX | Maximum N2 pressure | MPa (psi) | - | Engine in operation |

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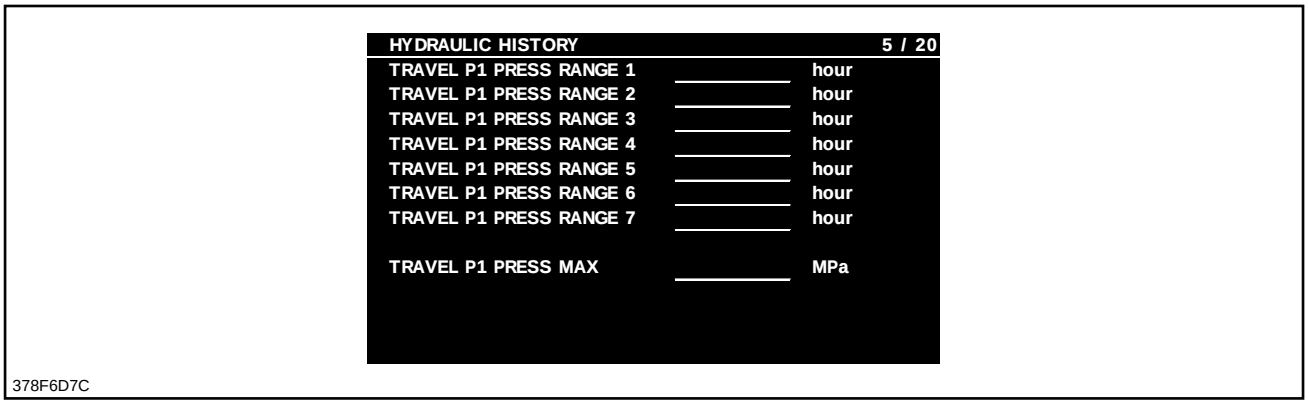

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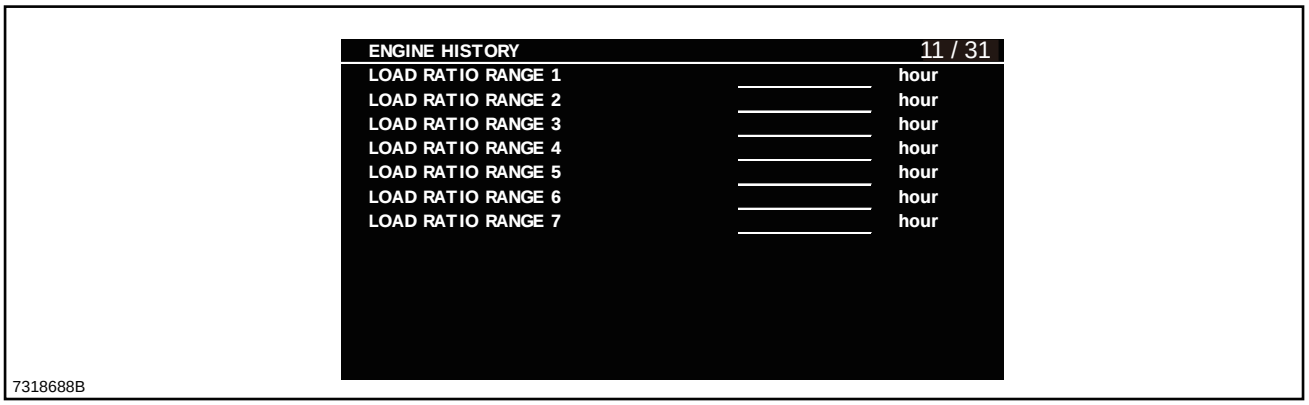


| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| LOAD RATIO RANGE 1 | Load ratio; time distribution | hour | Less than 30% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 2 | Load ratio; time distribution | hour | Less than 40% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 3 | Load ratio; time distribution | hour | Less than 50% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 4 | Load ratio; time distribution | hour | Less than 60% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 5 | Load ratio; time distribution | hour | Less than 70% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 6 | Load ratio; time distribution | hour | Less than 80% | In 10 sec. after the engine starts |
| LOAD RATIO RANGE 7 | Load ratio; time distribution | hour | 80% or more | In 10 sec. after the engine starts |

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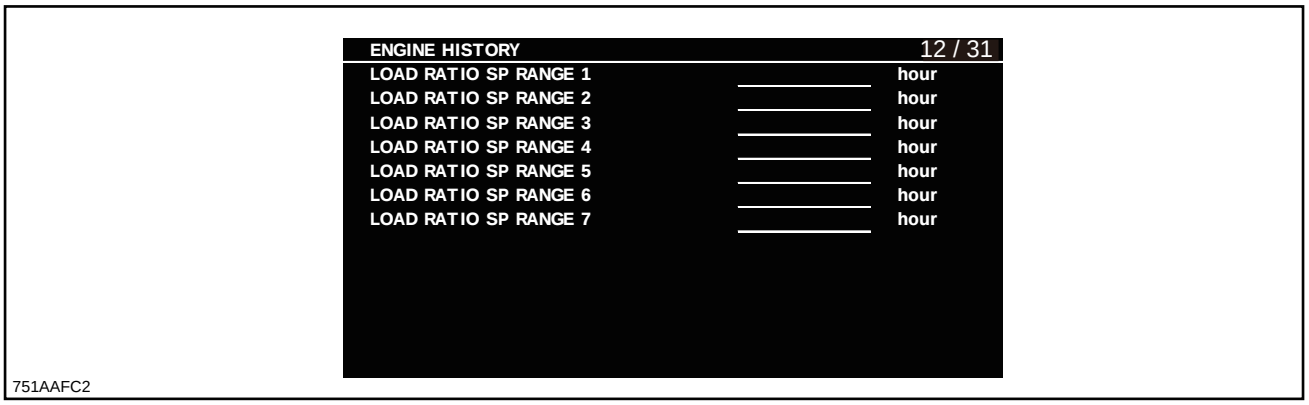
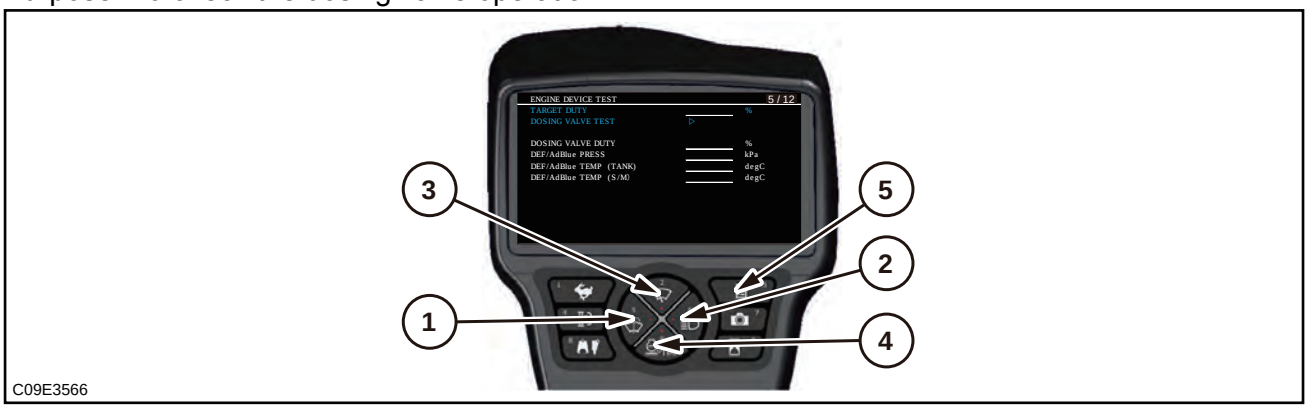



| Display | Explanation | Unit | Judgment condition | Judgment start condition |
|---|---|---|---|---|
| LOAD RATIO SP RANGE 1 | Load ratio (SP); time distribution | hour | Less than 30% | In 10 sec. after the engine starts |
| LOAD RATIO SP RANGE 2 | Load ratio (SP); time distribution | hour | Less than 40% | In 10 sec. after the engine starts |
| LOAD RATIO SP RANGE 3 | Load ratio (SP); time distribution | hour | Less than 50% | In 10 sec. after the engine starts |
| LOAD RATIO SP RANGE 4 | Load ratio (SP); time distribution | hour | Less than 60% | In 10 sec. after the engine starts |
| LOAD RATIO SP RANGE 5 | Load ratio (SP); time distribution | hour | Less than 70% | In 10 sec. after the engine starts |

■Dosing Test

Purpose: To check the dosing valve operation.




| Display | Explanation | Unit | Remarks |
|---|---|---|---|
| TARGET DUTY | Degree of opening of dosing valve | % | Items selectable. The degree of opening of the dosing valve can be specified. Initial value: 50.0 |
| DOSING VALVE TEST | Dosing valve test | - | The dosing valve is driven (for 10 seconds). |
| | | | |
| DOSING VALVE DUTY | Dosing DUTY | % | |
| DEF/AdBlue PRESS | Urea pressure | kPa (psi) | |
| DEF/AdBlue TEMP(TANK) | Urea temperature (inside tank) | degC | |
| DEF/AdBlue TEMP(S/M) | Urea temperature (inside supply module) | degC | |

Procedure

-Condition for the test-

The engine is stopped.

[1] Set the target dosing valve position.

Select "TARGET DUTY" (degree of opening target dosing valve) using SW (3) and (4).

Press SW (1) and (2) to set the target test position.

Available set range: 0 to 100%

After the setting is completed, press SW (5).

[2] Test execution

Select "DOSING VALVE TEST" (dosing valve test) using SW (3) and (4).

Hold down SW (2) for 3 seconds, then "▷" changes to "▶" and the test starts.

The test will be continued for 10 seconds.

[3] Test finish

After 30 seconds, the engine automatically returns to the normal state.

QUICK COUPLER

| Value | Contents | Remarks |
|---|---|---|
| 0 | None | "?" appears in white when the screen is changed. |
| 1 | Yes | |

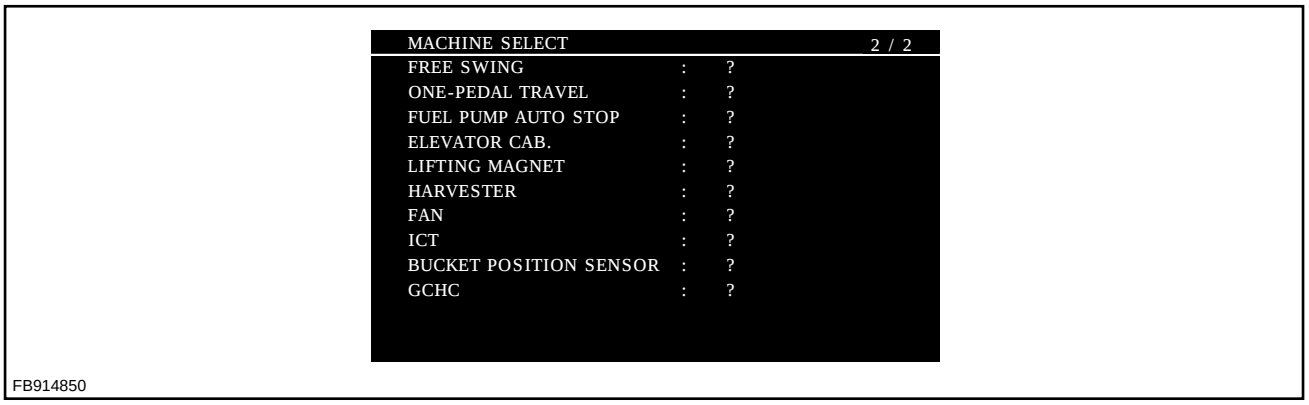
OVERLOAD WARNING

| Value | Contents | Remarks |
|---|---|---|
| 0 | None | "?" appears in white when the screen is changed. |
| 1 | Available (EU Type) | |
| 2 | Available (Japan Type) | |

ANTI-INTERFERENCE

| Value | Contents | Remarks |
|---|---|---|
| 0 | None | "?" appears in white when the screen is changed. |
| 1 | Yes | |

2. Model selection

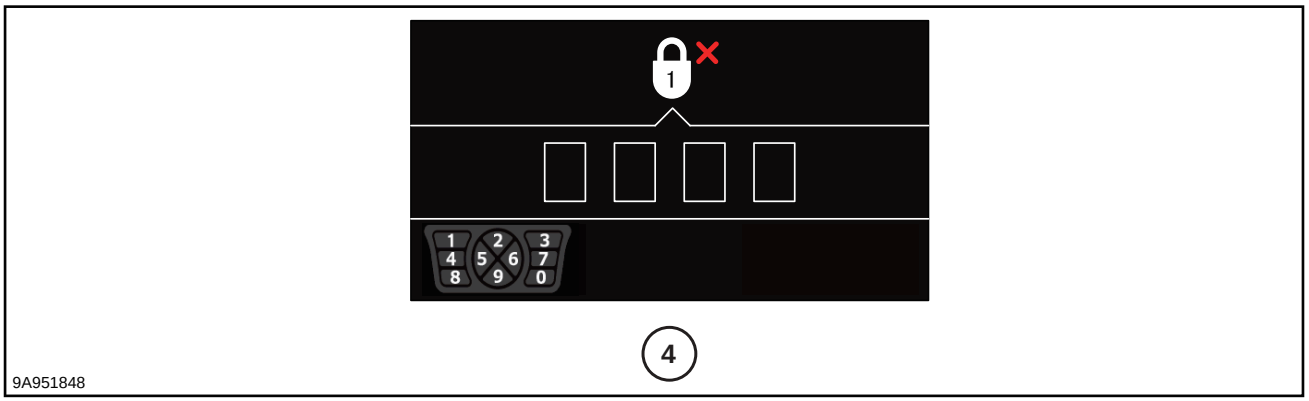



| | |
|---|---|
| FREE SWING | Free swing |
| ONE-PEDAL TRAVEL | One-pedal travel |
| TRAVEL ALARM | Travel alarm |
| FUEL PUMP AUTO STOP | Feed pump with automatic stop function |
| ELEVATOR CAB | Elevator cab |
| LIFTING MAGNET | Lifting magnet |
| HARVESTER | Harvester |
| FAN | Fan |
| ICT | Informational construction |
| BUCKET POSITION SENSOR | Bucket position detection sensor |
| GCHC | Grapple close holding circuit |

FREE SWING

| Value | Contents | Remarks |
|---|---|---|
| 0 | None | "?" appears in white when the screen is changed. |
| 1 | Yes | |

・ To delete it

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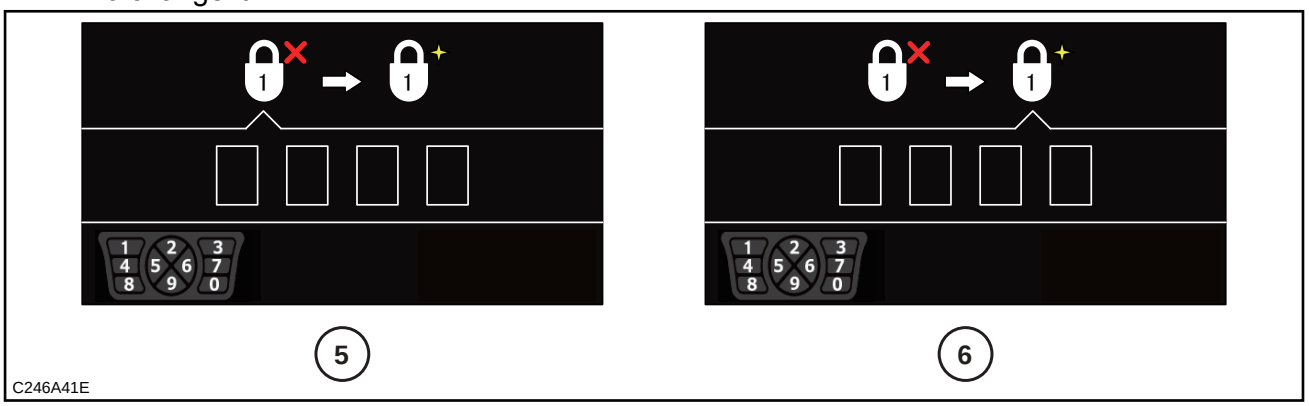
| | |
|---|---|
| 4 | Deletion screen |

a. Enter the password management screen (1).
b. Choose the desired item for password setup.
c. Choose "TURN PASSWORD OFF."
d. Enter the registered password. (Enter it on the deletion screen (4).)
e. On completion of the process, the password management screen (1) will be redisplayed.
   ・ When a wrong password is entered, the previous screen will be redisplayed without deleting the password.

・ To change it

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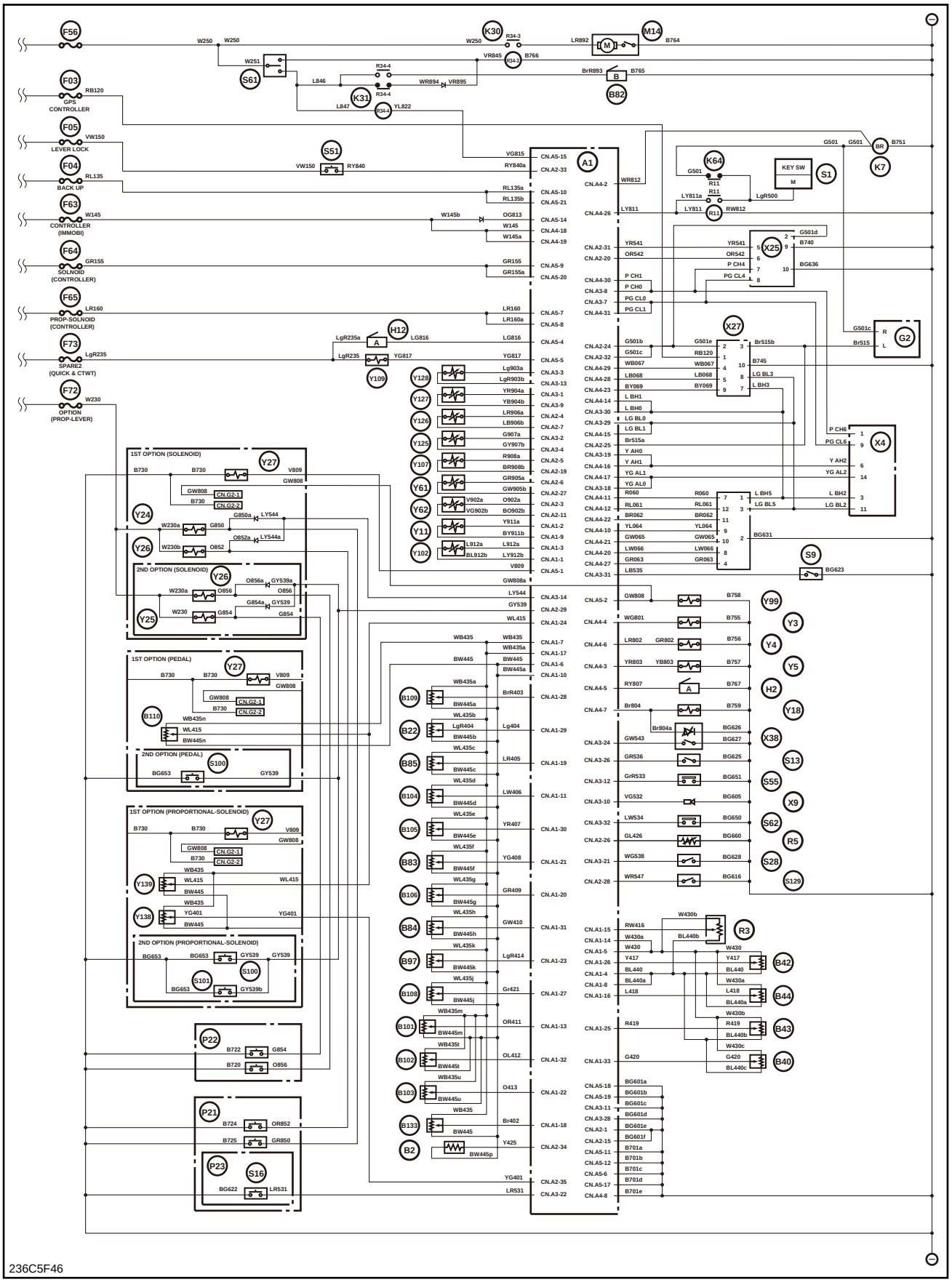
| | |
|---|---|
| 5 | Change screen (from old to new) |
| 6 | Change screen (new) |

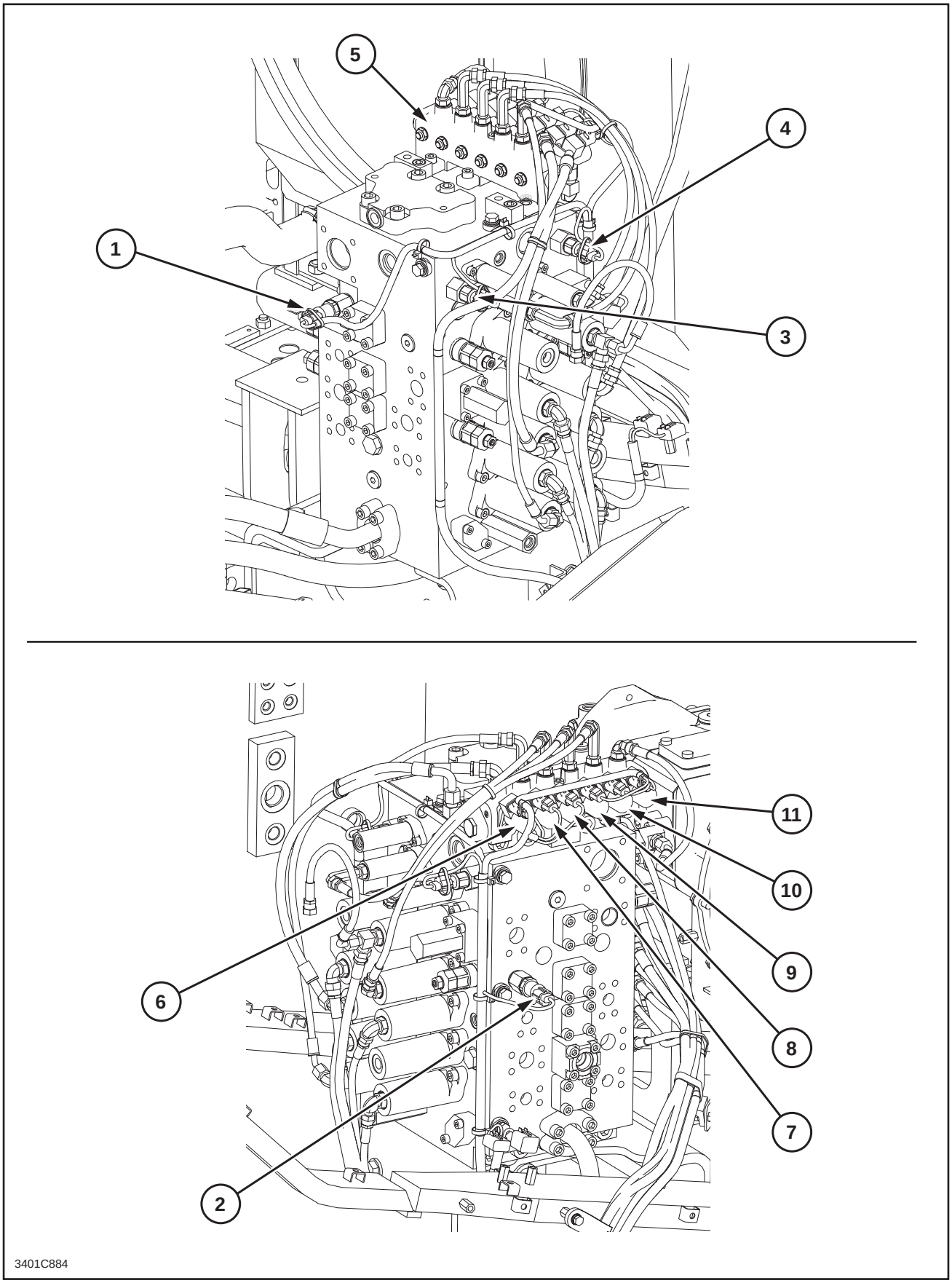
a. Enter the password management screen (1).
b. Choose the desired item for password setup.
c. Choose "CHANGE PASSWORD."
d. Enter the registered password. (Enter it on the change screen (5).)
e. Enter the new password to register. (Enter it on the change screen (6).)
f. On completion of the process, the password management screen (1) will be redisplayed.

# Block diagram

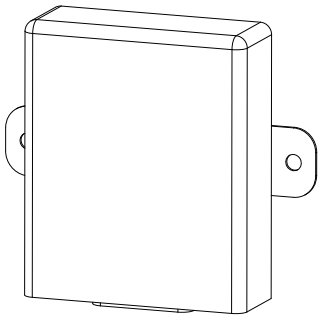
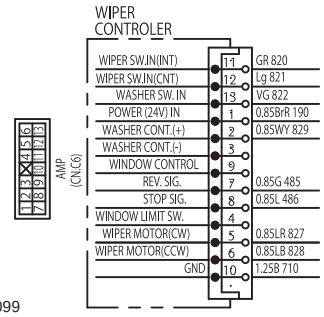
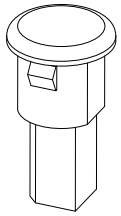
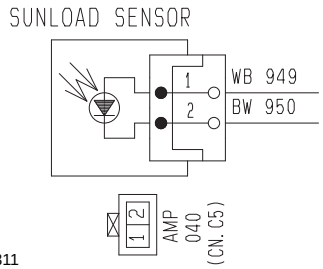
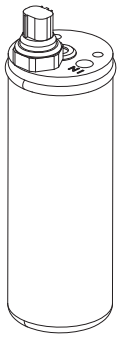
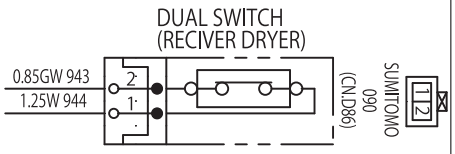
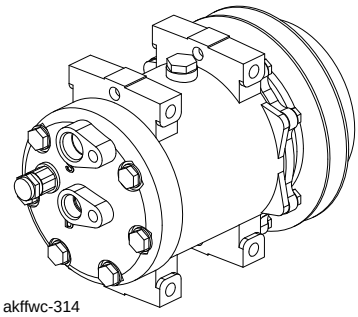
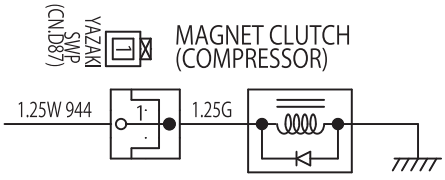
## Main controller



## Main Unit Center Section Layout Diagram




| | | | | | |
|---|---|---|---|---|---|
| 1 | Arm out pressure sensor | 5 | 6 stack proportional valve | 9 | Arm regeneration release control |
| 2 | Arm in pressure sensor | 6 | Bucket stroke restriction | 10 | Boom down regeneration |
| 3 | N2 pressure sensor | 7 | Straight travel control | 11 | Arm variable parameter control |
| 4 | N1 pressure sensor | 8 | Arm 2 variable parameter control | | |

| Name | Shape | Circuit | Remarks |
|---|---|---|---|
| Wiper controller |  akffwc-306 |   93981099 | Sumitomo Part No.: KHN3392 |
| Solar radiation sensor |  akffwc-310 |   akffwc-311 | Sumitomo Part No.: KHR10540 |
| Receiver dryer (switch) |  akffwc-312 |   9A6A9576 | Sumitomo Part No.: KHR13590 |
| Air conditioner compressor (magnetic clutch) |  akffwc-314 |   A922933C | Sumitomo Part No.: KHR3197 |

## Removal and Installation of FVM Controller

Items to prepare

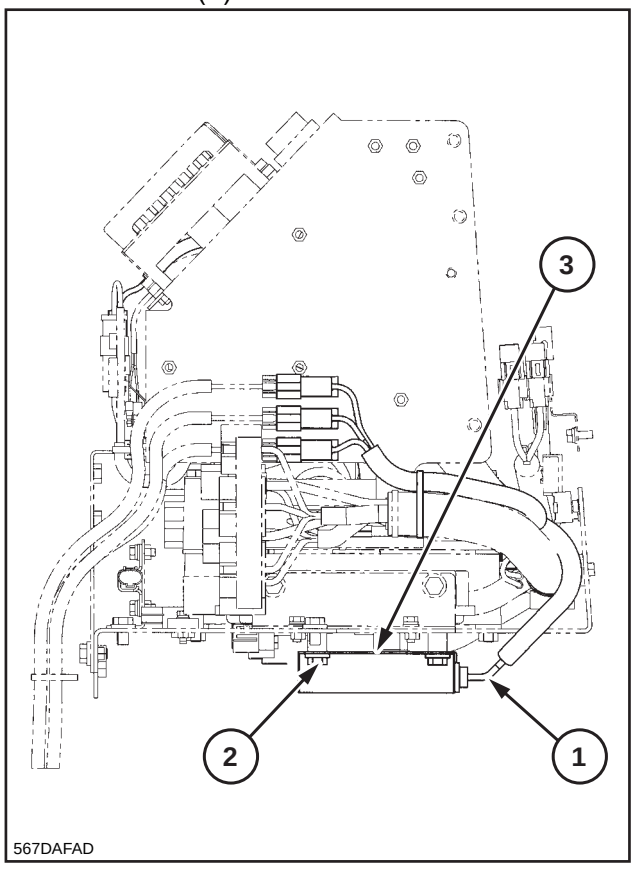
- Wrench 15 mm (0.591 in.)

### Removal of FVM Controller

1. Disconnect the battery ground cable from the battery.

> ⚠ Caution
>
> - While the indicator (LED) of the battery disconnect switch is lit, do not turn OFF the battery disconnect switch or disconnect its negative cable from the battery. (After key OFF, lit for a maximum duration of 3 minutes)

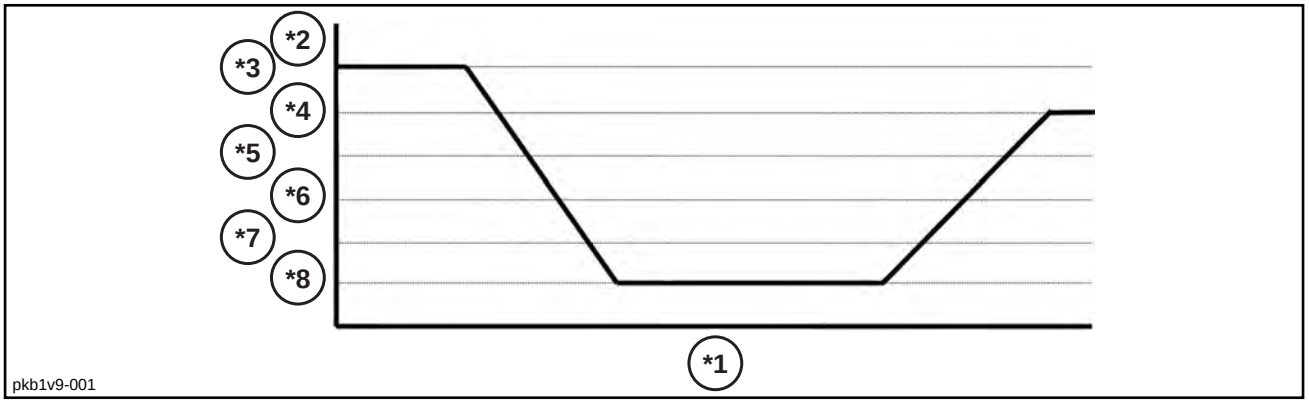
2. Remove the rear trim.Refer to the "Removal and Installation of Cab Assembly" procedure.
3. Remove the connector (1).
4. Remove the 4 bolts (2) with a wrench 13 mm (0.512 in.) to remove the FVM controller (3).




### Installation of FVM Controller

1. Mount the DCU in the reversed order of the procedure for removal.
   If the FVM controller is replaced, set up the FVM.
   Refer to "How to Set FVM."

[6] Auto air flow control is restricted by the cold blast prevention control described in (4), which is the next item.




| | | | | | |
|---|---|---|---|---|---|
| *1 | Target blow temperature | *4 | M4 | *7 | M1 |
| *2 | Auto air flow | *5 | M3 | *8 | Lo |
| *3 | Hi | *6 | M2 | | |

Relationship between air flow and target blow temperature

| Display refreshing and air flow output correspondence table | | |
|---|---|---|
| Current display | Item | Target % (about) |
| Lo display | Output range changed to M1 | When 44 % or higher |
| M1 display | Output range changed to Lo | When 40 % or lower |
| | Output range changed to M2 | When 52 % or higher |
| M2 display | Output range changed to M1 | When 48 % or lower |
| | Output range changed to M3 | When 61 % or higher |
| M3 display | Output range changed to M2 | When 57 % or lower |
| | Output range changed to M4 | When 74 % or higher |
| M4 display | Output range changed to M3 | When 70 % or lower |
| | Output range changed to Hi | When 88 % or higher |
| Hi display | Output range changed to M4 | When 84 % or lower |

4. Cold blast prevention control

The air flow is restricted according to the value of the coolant temperature data and other parameters sent from the vehicle side via CAN communication.
The air flow restriction has 2 levels - air flow 0 and air flow Lo. Whether or not to use the restriction is determined from the judgment results.

[1] Conditions under which cold blast prevention control is used

a. When air flow is set to AUTO.

b. When set temperature - inside air sensor temperature ≧ 11.

c. When the coolant temperature signal from vehicle is the lower than 86.0°F signal or the 86.0°F or higher but lower than 113.0°F signal.

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | HL. E is displayed on the panel set temperature display section. | | Inspect and repair or replace part. | Go to Step 2 |
| 2 | HL. * is displayed on the panel set temperature display section.<br>* is No. 0 to 9. | | ・ Inside air sensor or harness disconnection or short<br>・ The inside air sensor connector is disconnected or has a contact defect.<br>See the Monitor Mode section too.<br>Inspect and repair or replace part. | Go to Step 3 |
| 3 | When the set temperature is 32.0 and the blow mode is set to foot mode, the blow temperature rises. | 32.0°C (89.6°F) | Go to Step 4 | Go to Step 5 |
| 4 | Warm air is flowing into the inside air sensor section. | | Inspect the duct or eliminate the cause of the warm air infiltration. | Computer breakdown or inside air sensor defect Inspect and replace. |
| 5 | The air mix damper is at the HOTMAX position. | | Inspect the warm coolant lines. | Go to Step 6 |
| 6 | If motor actuator operation stops midway, remove the cause or correct the problem, and then measure the operating force.<br>Is it 1.5 kgf or less? | 1.5 kgf or less | Motor actuator breakdown or controller breakdown Replace. | ・ Inspect, repair, or replace the motor actuator lever link section.<br>・ Clean the lever link section, and then apply grease. |

The blower motor does not rotate.

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | With the flow set to HI, battery voltage is applied to the terminals (+ and -) of the blower motor. (Note: 1) | | Replace the blower motor. | Go to Step 2 |
| 2 | The battery voltage is applied between the blower motor (+) power supply red/blue and the body. | | Go to Step 3 | Go to Step 5 |
| 3 | Voltage of about 10 V is applied between the blower amp brown/yellow line and ground. | About 10 V | Go to Step 4 | Replace computer. |
| 4 | Remove the blower amp and refer to the section on Blower Amp Inspection. Is there any abnormality?<br>No abnormality → Yes<br>Abnormality → No | | Inspect and repair the wire harness. | Eliminate the cause of the trouble, and then replace the blower amp. |

## Work Precautions

**⚠ Warning**

- Refrigerant gas filling involves handling dangerous high-pressure gas, so make sure that an experienced and qualified worker with the procedure performs this operation.
- Always wear protective eyewear.
- Gas entering the eyes may cause blindness.
- Refrigerant in the liquid state is very cold [about -26°C (-14.8°F)], so be very careful during handling.
- Refrigerant coming in contact with skin may cause frostbite.

Always use R134a refrigerant.

- Storage
  Keep service cans (hereinafter, cans) with refrigerant in them at 40°C (104.0°F) or below.
  The insides of the cans are highly pressurized and filled with refrigerant, so if the temperature rises there is the danger of internal pressure rising sharply and an explosion occurring.
  Never store in direct sunlight, in a closed vehicle, or near open flames.
  Be careful not to drop cans or have them collide with other objects.
- Filling operation
  When cans are heated in order to fill them with refrigerant, make sure that the service can valve and gauge manifold low-pressure valve are open and heat with water at 40°C (104.0 °F) or below.
  Direct heating or heating to 40°C (104.0°F) or higher may cause explosions, so use caution.
  If refrigerant filling is done after the engine is started, never open the gauge manifold high-pressure valve.
  This is very dangerous, as the high-pressure gas will flow in the opposite direction and may cause a can or charging hose explosion.
  Be careful not to allow the entry of dust or dirt into the air conditioner circuit.
  Air, moisture and dirt are very bad for the cooling cycle.
  Perform work quickly and accurately, and be especially careful to prevent the entry of foreign matter.
  Be careful not to overfill with gas.

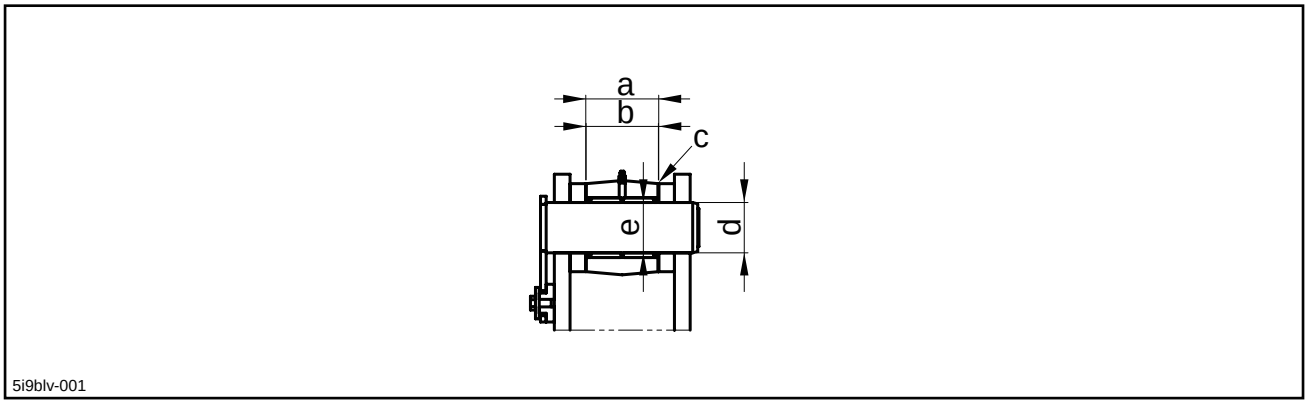
### Work Procedures

Air Conditioner Refrigerant Filling is Divided into the "Vacuum Operation" and "Gas Filling Operation".

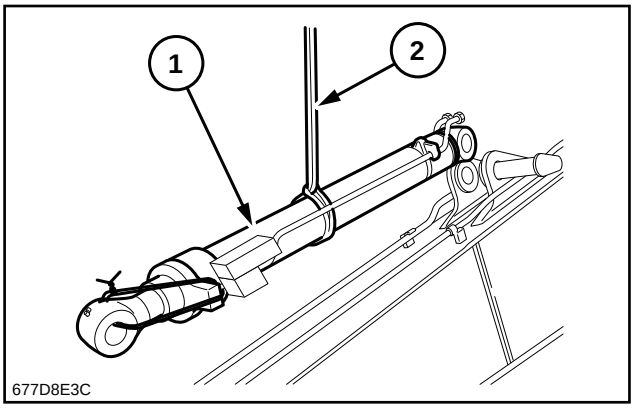
1. The "vacuum operation" consists of eliminating moisture in the air conditioner circuit.
   If there is any moisture left inside the air conditioner circuit, various problems may occur during operation such as freezing in the small hole of the expansion valve causing the circuit to clog and rust developing in the circuit.
   For this reason, perform vacuuming before filling the circuit with refrigerant. This operation consists of eliminating moisture inside the circuit through boiling and evaporation.
2. The "gas filling operation" consists of filling the circuit with refrigerant after the vacuum operation.
   Gas filling does not only affect the cooling capabilities of the air conditioner, it also affects the life of the parts which make up the circuit.
   Severely overfilling the circuit will cause pressure inside the circuit to be abnormally high, and this will cause reductions in the cooling ability of the air conditioner.
   Additionally, if pressure is extremely low, the circulation of lubricating oil within the compressor will be poor and this will cause seizing with sliding parts of the compressor.
   Because the gas filling operation itself involves handling high-pressure gas, performing the operation using an incorrect procedure is very dangerous.
   Follow the operation and observe all precautions indicated in this text to correctly perform refrigerant filling.

| Part name | Code | Measurement dimension [mm (in.)] | Standard value [mm (in.)] | Usage limit [mm (in.)] | Judgment | Solution |
|---|---|---|---|---|---|---|
| Arm | a | | 121 (4.764) | 127 (5.000) | Acceptable/ Unacceptable | Replacement |
| Arm cylinder (top section) | b | | 120 (4.724) | 118 (4.646) | Acceptable/ Unacceptable | Replacement |
| Clearance | c | | 0.5 - 1.8 (0.0197 - 0.0709) | Shim adjustment | Acceptable/ Unacceptable | Adjustment with shims |
| Pin | d | D | D90 (3.543) | D89 (3.504) | Acceptable/ Unacceptable | Replacement |
| Bushing (arm cylinder) | e | D | D90 (3.543) | D91.5 (3.6024) | Acceptable/ Unacceptable | Replacement |

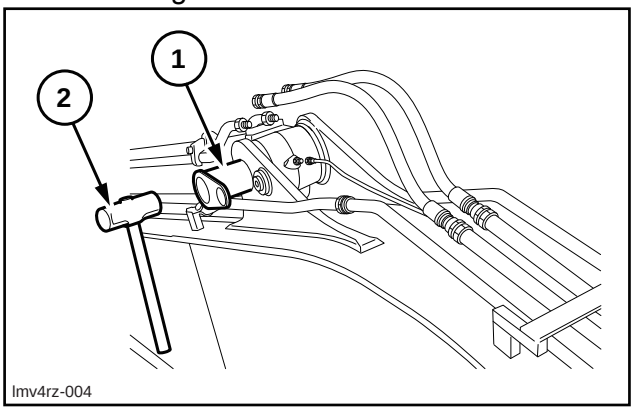
7. Arm and Bucket Cylinder Installation Section



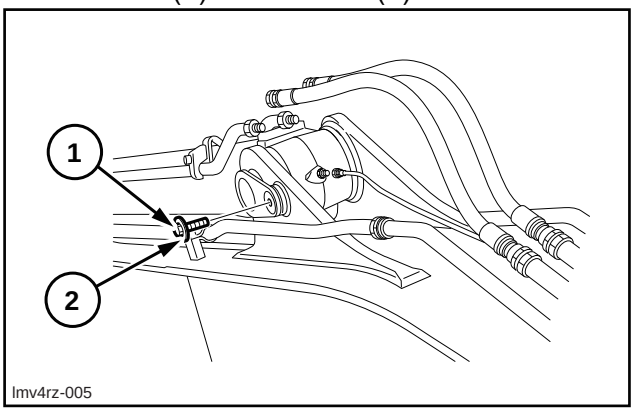

| Part name | Code | Measurement dimension [mm (in.)] | Standard value [mm (in.)] | Usage limit [mm (in.)] | Judgment | Solution |
|---|---|---|---|---|---|---|
| Arm | a | | 116 (4.567) | 112 (4.409) | Acceptable/ Unacceptable | Replacement |
| Bucket cylinder (foot section) | b | | 115 (4.528) | 113 (4.449) | Acceptable/ Unacceptable | Replacement |
| Clearance | c | | 0.5 - 1.8 (0.0197 - 0.0709) | Shim adjustment | Acceptable/ Unacceptable | Adjustment with shims |
| Pin | d | D | D80 (3.150) | D79 (3.110) | Acceptable/ Unacceptable | Replacement |
| Bushing (bucket cylinder) | e | D | D80 (3.150) | D81.5 (3.2087) | Acceptable/ Unacceptable | Replacement |



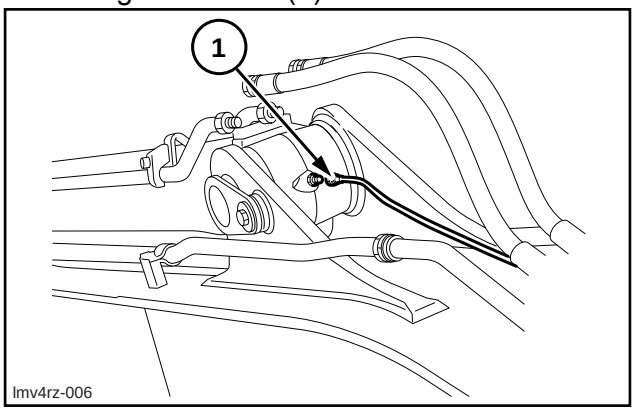

4. Align the arm cylinder with the boom and use a hammer (2) to push in the pin (1).
   - If the pin is hard to insert, there is a load on the pin.
   - When inserting the pin, be careful not to damage the installed dust seals.



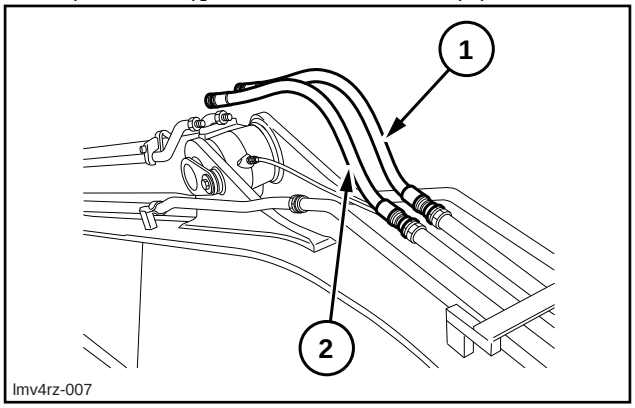

5. Use a wrench [19 mm (0.748 in.)] to tighten the bolt (1) and washer (2).



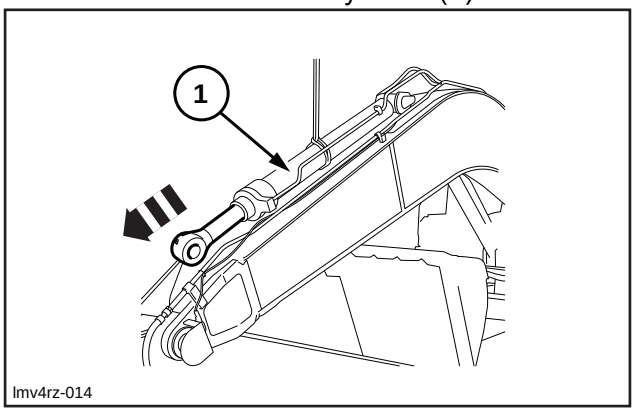

6. Use a wrench [19 mm (0.748 in.)] to install the grease hose (1).




7. Use a wrench [41 mm (1.614 in.)] to install the hose (1) and use a wrench [36 mm (1.417 in.)] to install the hose (2).

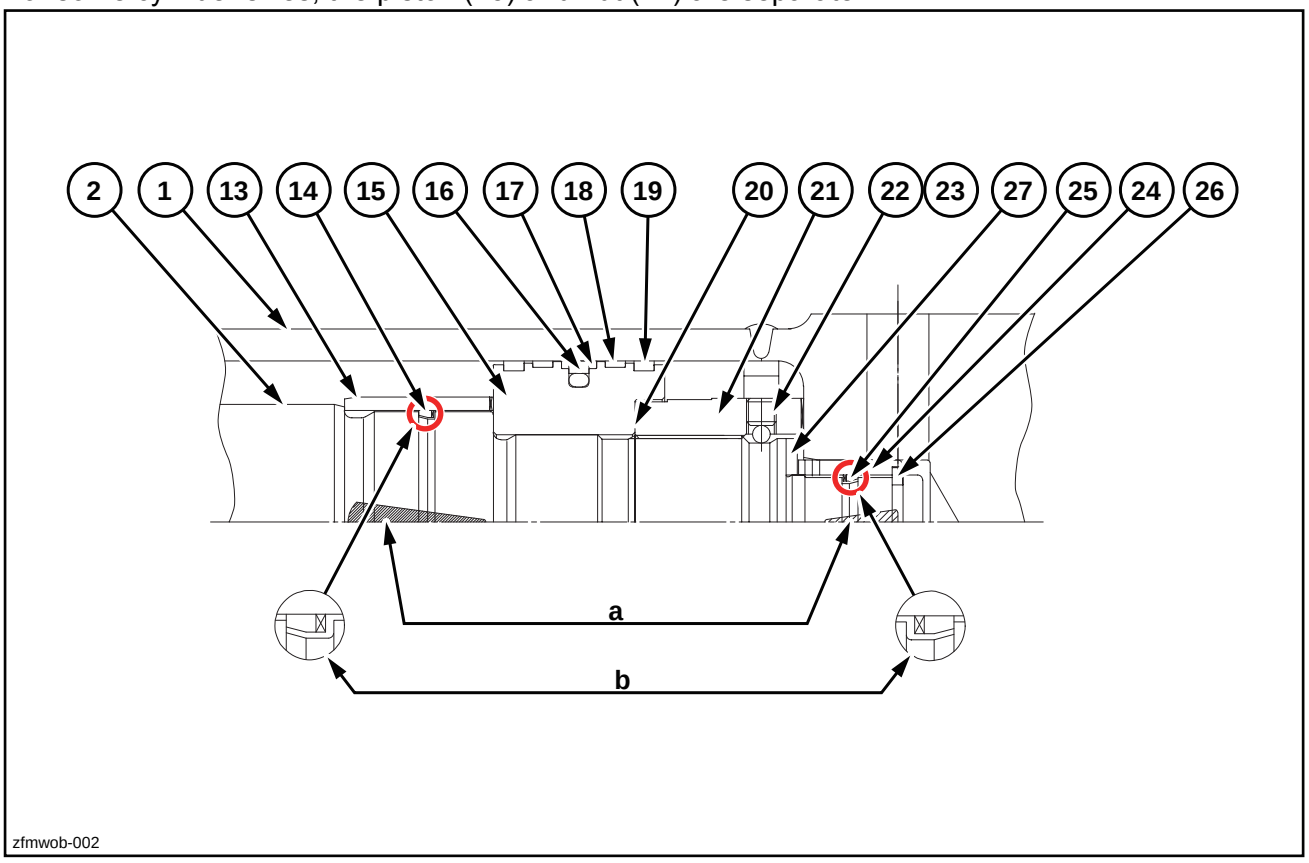



8. Start the engine, move the arm in at idle, and extend the arm cylinder (1) rod.




9. Align the arm cylinder (1) with the arm pin hole and use a hammer (3) to insert the pin (2).
   Be careful. The arm and arm cylinder rod may come out of place at this time.

For some cylinder sizes, the piston (15) and nut (21) are separate.




| | | | | | |
|---|---|---|---|---|---|
| 1 | Cylinder tube | 17 | Backup ring | 23 | Steel ball |
| 2 | Piston rod | 18 | Slide ring | 24 | Cushion ring |
| 13 | Cushion ring | 19 | Slide ring | 25 | Cushion seal |
| 14 | Cushion seal | 20 | Shim | 26 | Stopper |
| 15 | Piston | 21 | Nut | 27 | Snap ring |
| 16 | Seal ring | 22 | Locking screw | | |

| | |
|---|---|
| a | Use caution with the direction of the cut surfaces during installation |
| b | Face the "slit" to the piston side. |

Example of parts numbers for separated piston and nut

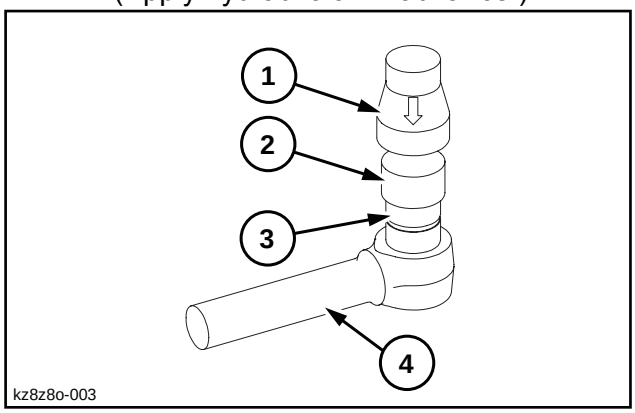
- Seal ring and backup ring
  The seal ring (16) is positioned at the center of the piston (15) and uses the tension force of the O-ring to seal the ring-shaped gap between the piston and the cylinder tube (1) and form chambers with a high-pressure side and a low-pressure side with the piston as the boundary.
  The backup ring (17) has the function of suppressing extrusion of the seal ring into the gap between the piston and the cylinder tube when the pressure operates and of improving durability.
- Slide ring
  Slide rings are positioned at both ends of the seal ring (16) and contact the inside surface of the cylinder tube (1).
  Together with the bushing (4) positioned on the inside surface of the cylinder head (3), the wear ring divides the lateral load applied to the cylinder and moves linearly relative to the inside surface of the cylinder tube.
  Furthermore, it supports one end of the piston rod (2) and has the functions of minimizing eccentricity, which has a negative impact on the sealing, and buries and captures any impurities trapped between the cylinder tube and the slide rings (18) (19).
- Cushion ring (for separated piston and nut)

Assembly Procedures (made by KYB)

> **Caution**
>
> If a part with peeling paint is assembled, the peeled off paint can get inside the cylinder. This causes oil leaks, so work being very careful to prevent this.

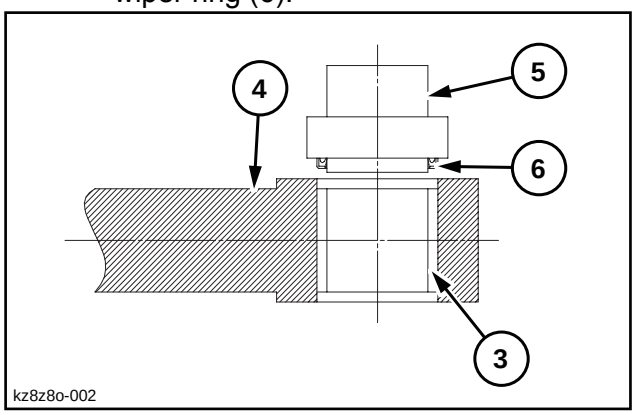
1. Installation of pin bushing

[1] Use the installation jig to press fit onto the piston rod (4) and into the tube. (Apply hydraulic oil in advance.)




| | |
|---|---|
| 1 | Press |
| 2 | Installation jig |
| 3 | Pin bushing |

[2] Use the metal block (5) to install the wiper ring (6).



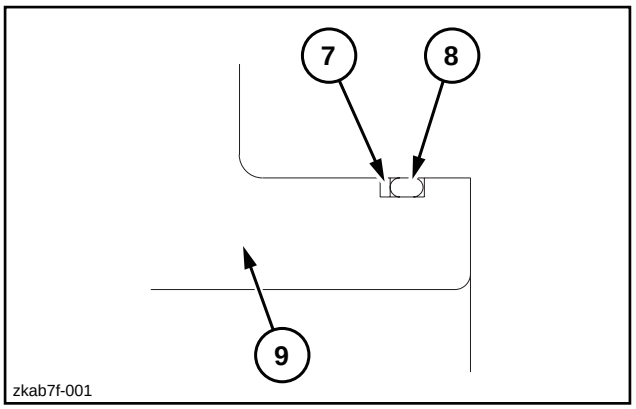

| | |
|---|---|
| 3 | Pin bushing |
| 4 | Piston rod |

2. Replacement of seals

[1] When disassembling the cylinder, replace all the seals.

[2] O-rings

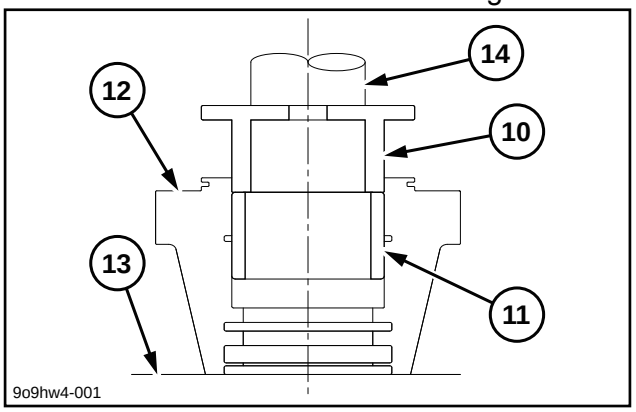
- Clean the mounting groove well, and then mount the backup ring (7) and O-ring (8).
  Foreign matter in the groove section would cause an oil leak.
- Be careful about the location of the backup ring.
- Apply grease or hydraulic oil to the backup ring and O-ring so that they slide easily, and then install them.
  If they are sliding poorly, O-ring may become twisted during assembly, which causes oil leaks.




| | |
|---|---|
| 9 | Cylinder head |

3. Assembly of cylinder head assembly

[1] Use the bushing press fit jig (10) to press fit the bushing (11).
Apply hydraulic oil to the inside surface of the cylinder head in advance and after press fitting, check that there is no level difference at the bushing.



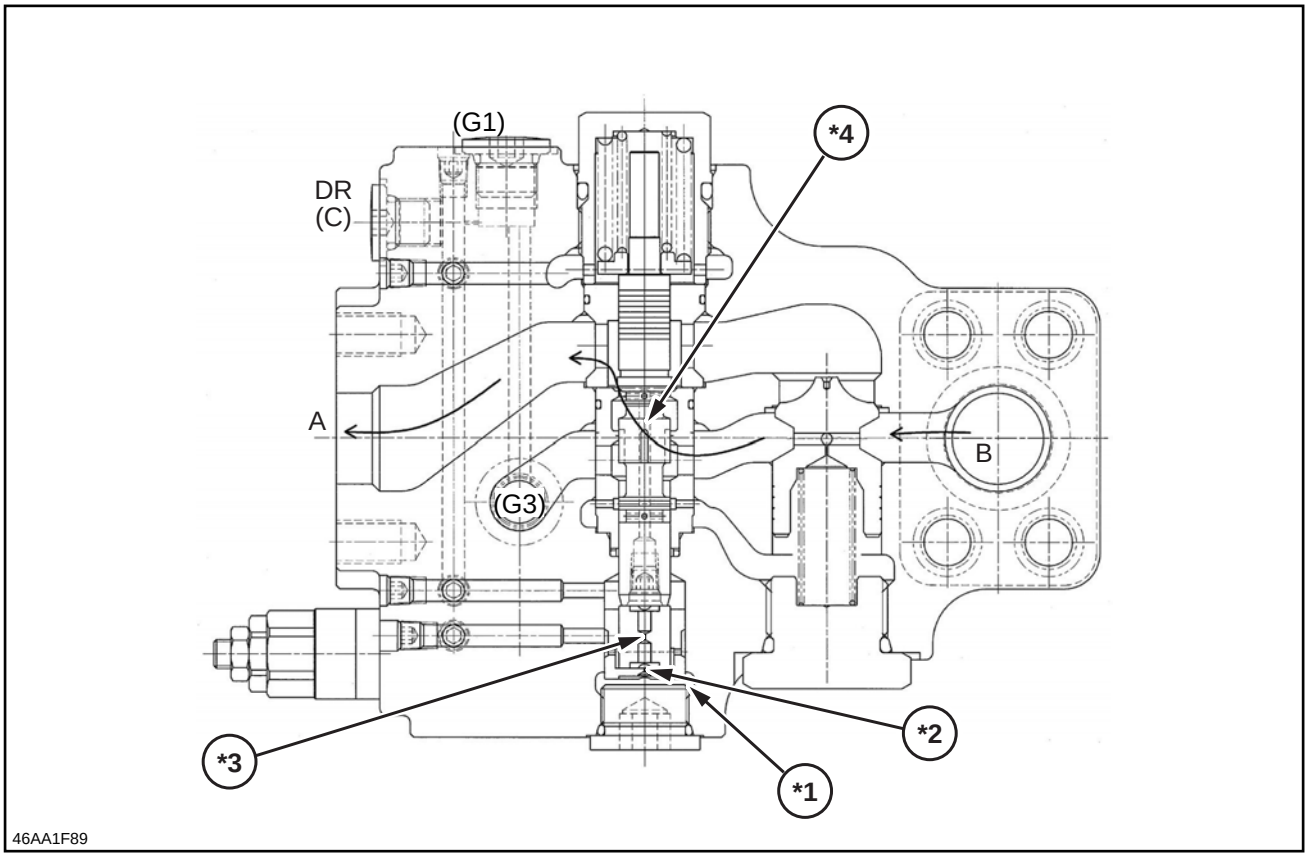

| | |
|---|---|
| 12 | Cylinder head |
| 13 | Pressing base |
| 14 | Press |

[2] Use the wiper ring press fit jig (15) to press fit the wiper ring (16).

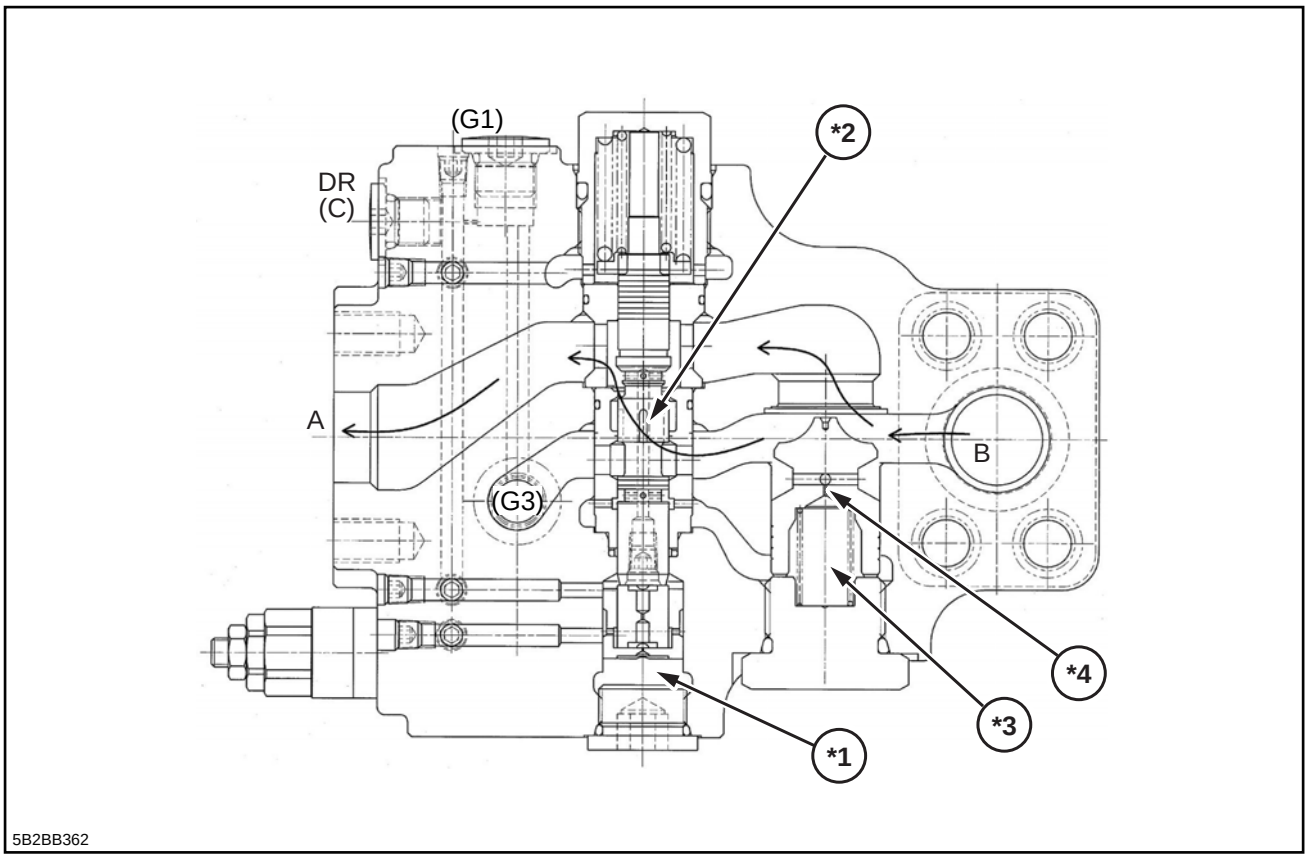
[3] Mount the backup ring (18) and U-ring (19) in the U-ring groove (17) in that order.

- Check the attachment direction of the U-ring and mount it carefully so as not to scratch it.
  Installing backwards can cause an oil leak.
- After mounting, check that there are no wrinkles or other permanent deformation remaining in the U-ring.

[4] Mount the buffer ring (20).




| | | | |
|---|---|---|---|
| *1 | Chamber (e) | *3 | Orifice (g) |
| *2 | Orifice (f) | *4 | Control section (h) |




| | | | |
|---|---|---|---|
| *1 | Chamber (e) | *3 | Spring chamber (i) |
| *2 | Control section (h) | *4 | Orifice (j) |

## Removal and Installation of Boom HBCV

**Caution**

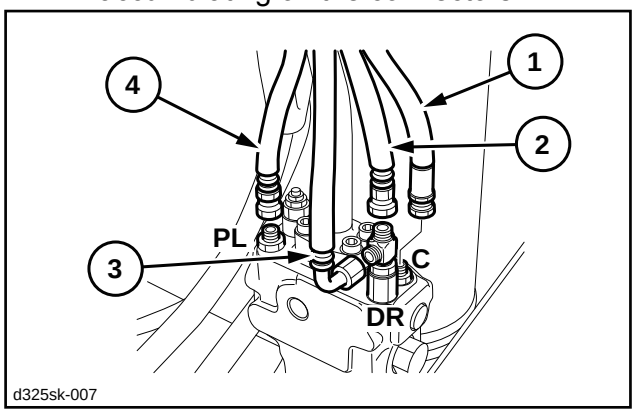
- Stop the machine on a level location with good footing.
- Be sure to stop the engine before beginning work.
- When working together with others, always be sure to exchange signals and pay adequate attention to safety.
- Be sure to release hydraulic pressure before beginning work.

Items to prepare

- Wrench [ 19 mm ( 0.748 in. ), 22 mm ( 0.866 in. ), 27 mm ( 1.063 in. ) ]
- Hexagon wrench [ 8 mm ( 0.315 in. ) ]
- Marking pen
- Caps
- Plugs
- Rag
- Cleaning fluid
- Crossties

### Removal of Boom HBCV

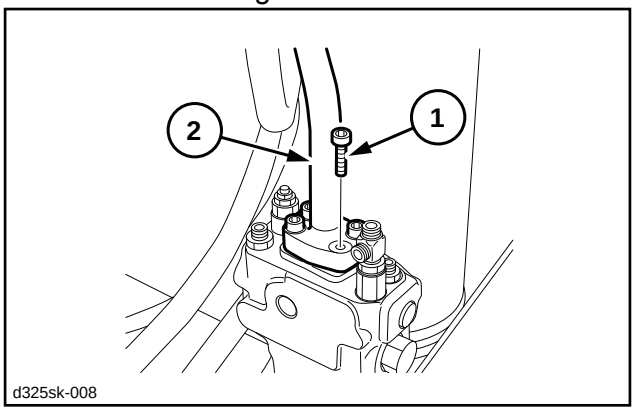
1. Use wrenches [19 mm (0.748 in.), 22 mm (0.866 in.)] to remove the hoses (1) (2) (3) (4) from the tool box side boom HBCV.
   - Mark the HBCV and hoses so that the connectors match at the time of assembly.
   - Use caps or plugs to cover the HBCV and lines to prevent any entry of water, dust or dirt.
   - Clean the HBCV and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



d325sk-007

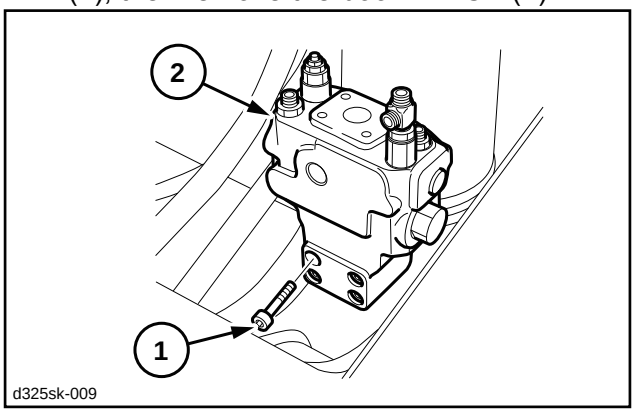
| | |
|---|---|
| 1 | Pilot hose [use 19 mm (0.748 in.) wrench)] |
| 2 | Drain hose [use 22 mm (0.866 in.) wrench] |
| 3 | Drain hose [use 22 mm (0.866 in.) wrench] |
| 4 | Pilot hose [use 22 mm (0.866 in.) wrench)] |

2. Use a hexagon wrench [8 mm (0.315 in.)] to remove the 4 hexagon socket head bolts (1), then remove the line (2).
   - Use caps or plugs to cover the HBCV and lines to prevent any entry of water, dust or dirt.
   - Clean the HBCV and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



d325sk-008

3. Use a hexagon wrench [8 mm (0.315 in.)] to remove the 4 hexagon socket head bolts (1), then remove the boom HBCV (2).



d325sk-009

4. Use wrenches [19 mm (0.748 in.), 22 mm (0.866 in.)] to remove the hoses (1) (2) (3) (4) from the cab side boom HBCV in Step 1.
   Use a wrench [27 mm (1.063 in.)] to remove the boom bottom pressure sensor (5).
   - Mark the HBCV and hoses so that the connectors match at the time of assembly.

## Removal and Installation of Boom (LF)

Caution

- Park the machine on a stable and flat site.
- Be sure to stop the engine before starting work.
- Work with sufficient caution by exchanging signs when cooperating with others.
- Wear protective gears (protective eyewear, safety shoes, etc.) for hammer work.
- Make sure to check slinging apparatus such as a nylon sling before starting work.
- Do not let anyone go under a suspended load.

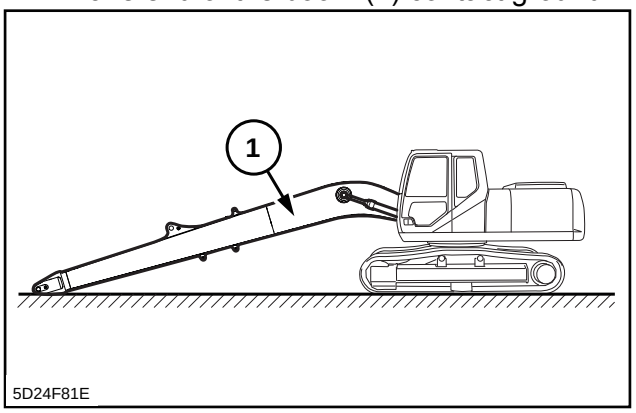
Items to prepare

- Wrench [10 mm (0.394 in.), 19 mm (0.748 in.), 27 mm (1.063 in.), 30 mm (1.181 in.), 41 mm (1.614 in.)]
- Slide hammer [24 mm (0.945 in.)]
- Nylon sling (that fulfills slinging capacity)
- Liftcrane (that fulfills slinging capacity)
- Marking pen
- Cap
- Plug
- Rag
- Striking rod
- Cleaning fluid
- Striking wood plank
- Square block etc.
- Wire etc.

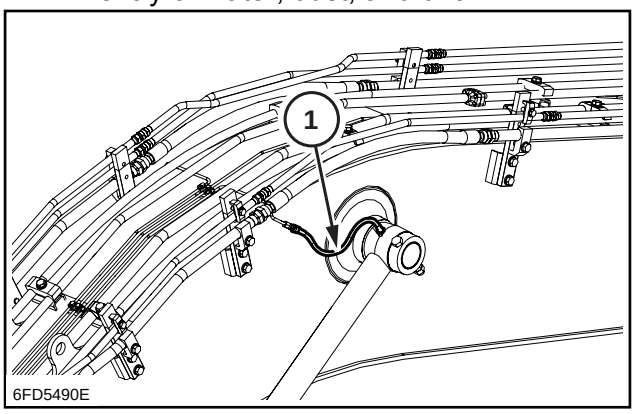
### Removal of Boom

- Remove the bucket. (Refer to "Removal and Installation of Bucket" for details.)
- Remove the bucket link. (Refer to "Removal and Installation of Bucket Link" for details.)
- Remove the bucket cylinder. (Refer to "Removal and Installation of Bucket Cylinder" for details.)
- Remove the arm cylinder. (Refer to "Removal and Installation of Arm Cylinder" for details.)
- Remove the arm. (Refer to "Removal and Installation of Arm" for details.)
- Here, procedure is explained with the case to leave the boom cylinder mounted on the frame.
  Refer to "Removal and Installation of Boom Cylinder" for the procedure to remove the boom cylinder as well.

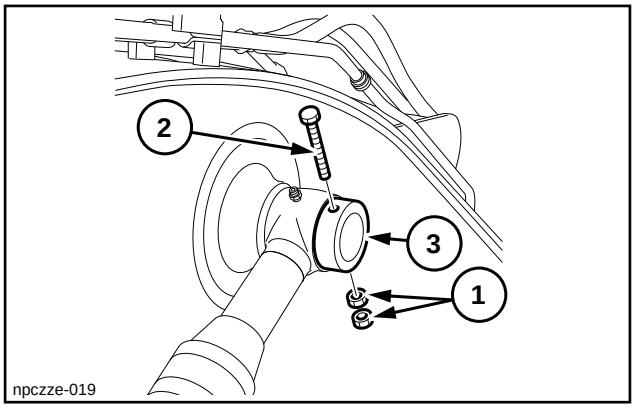
1. Have end of the boom (1) contact ground.



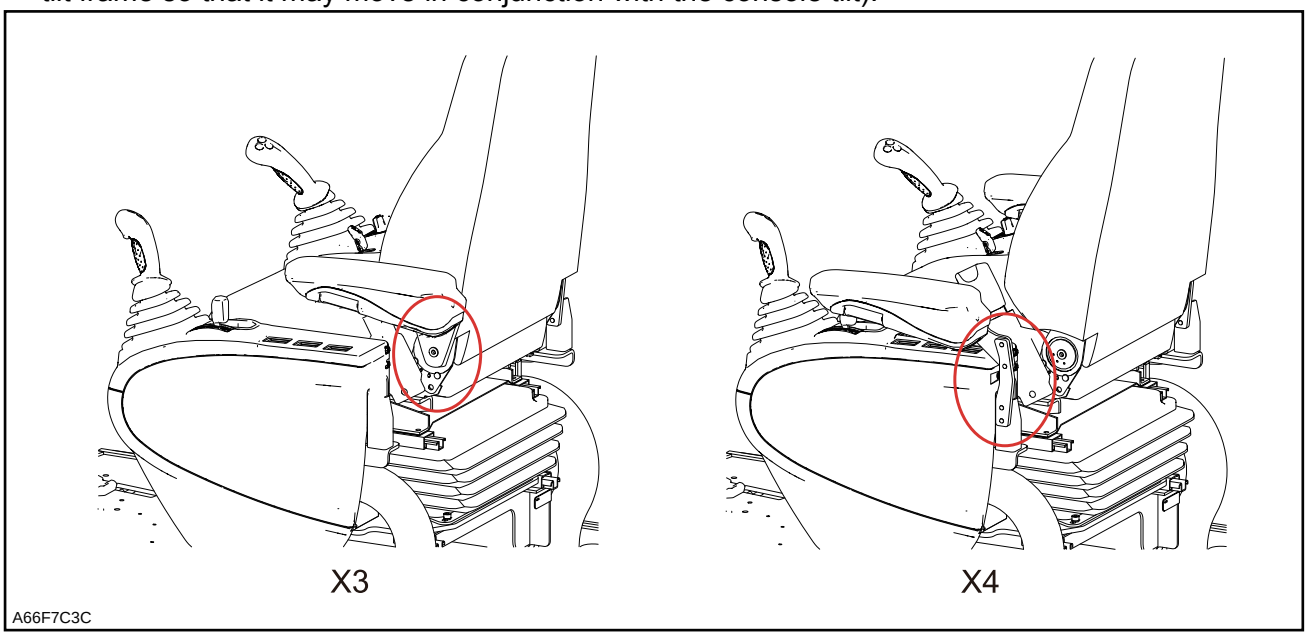

2. Remove the right and left grease hoses (1) with a wrench [10 mm (0.394 in.)].
   - Attach caps and plugs to prevent the entry of water, dust, and dirt.




3. Remove the 2 nuts (1) with a wrench [30 mm (1.181 in.)] and then pull out the bolt (2) to remove the fixation ring (3). Remove them in the cab side in the same manner.

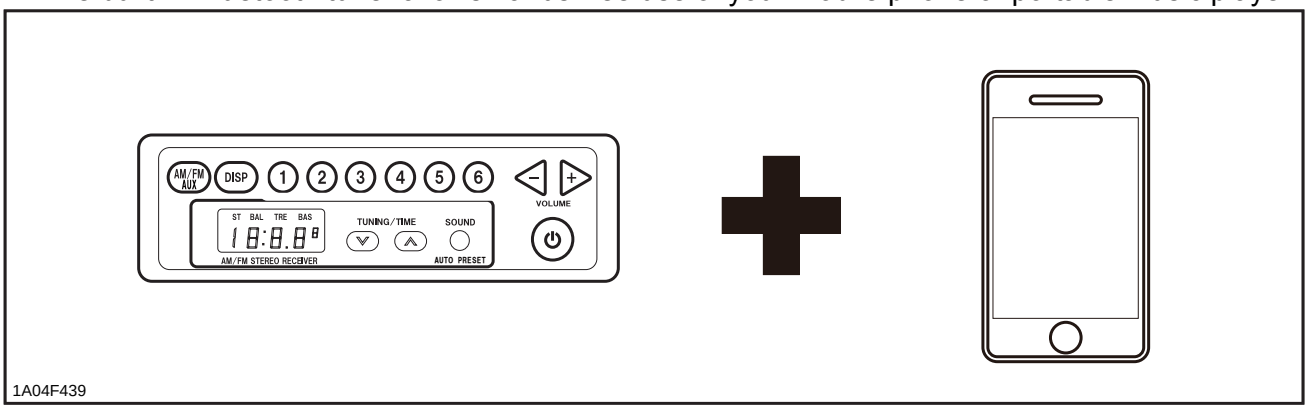


・ The armrest location is changed (in order to improve the ease of use, it is attached to the console tilt frame so that it may move in conjunction with the console tilt).

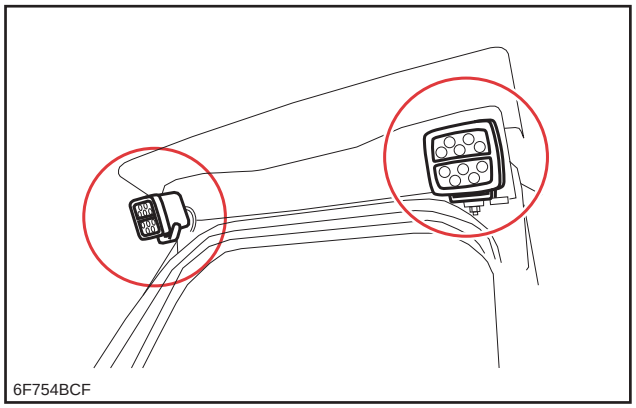



## Electrical Data

・ The built-in Bluetooth tuner allows hands-free use of your mobile phone or portable music player.

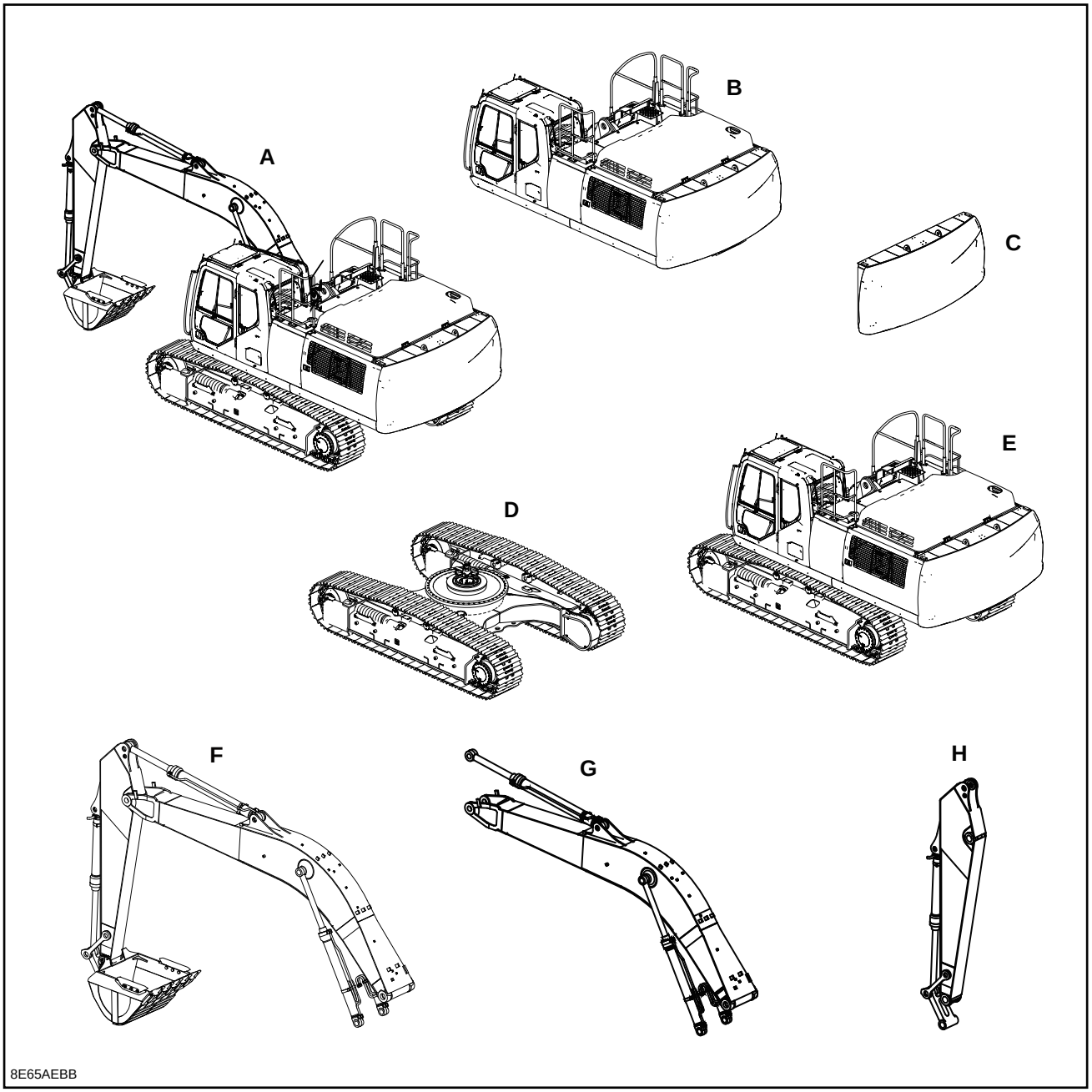



・ LED working lights are adopted (optional).




・ LED camera lights are added (optional).
They light up in conjunction with the working light.

## Divided Weight (LF)




| Code | Part name | Weight (kg) | Weight (lb) |
|---|---|---|---|
| A | Operating weight | 28800 | 63493.463 |
| B | Upper component (including CW and TTB) | 13500 | 29762.561 |
| C | Counterweight | 7370 | 16248.154 |
| D | Lower component (with grouser shoe) | 8930 | 19687.383 |
| E | Main unit weight | 23300 | 51367.975 |
| F | Attachments | 5510 | 12147.534 |
| G | Boom (including cylinder) | 3580 | 7892.590 |
| H | Arm (including cylinder and linkage) | 1590 | 3505.368 |

* The weights shown here are approximate values.

## Stand Alone Part Weight

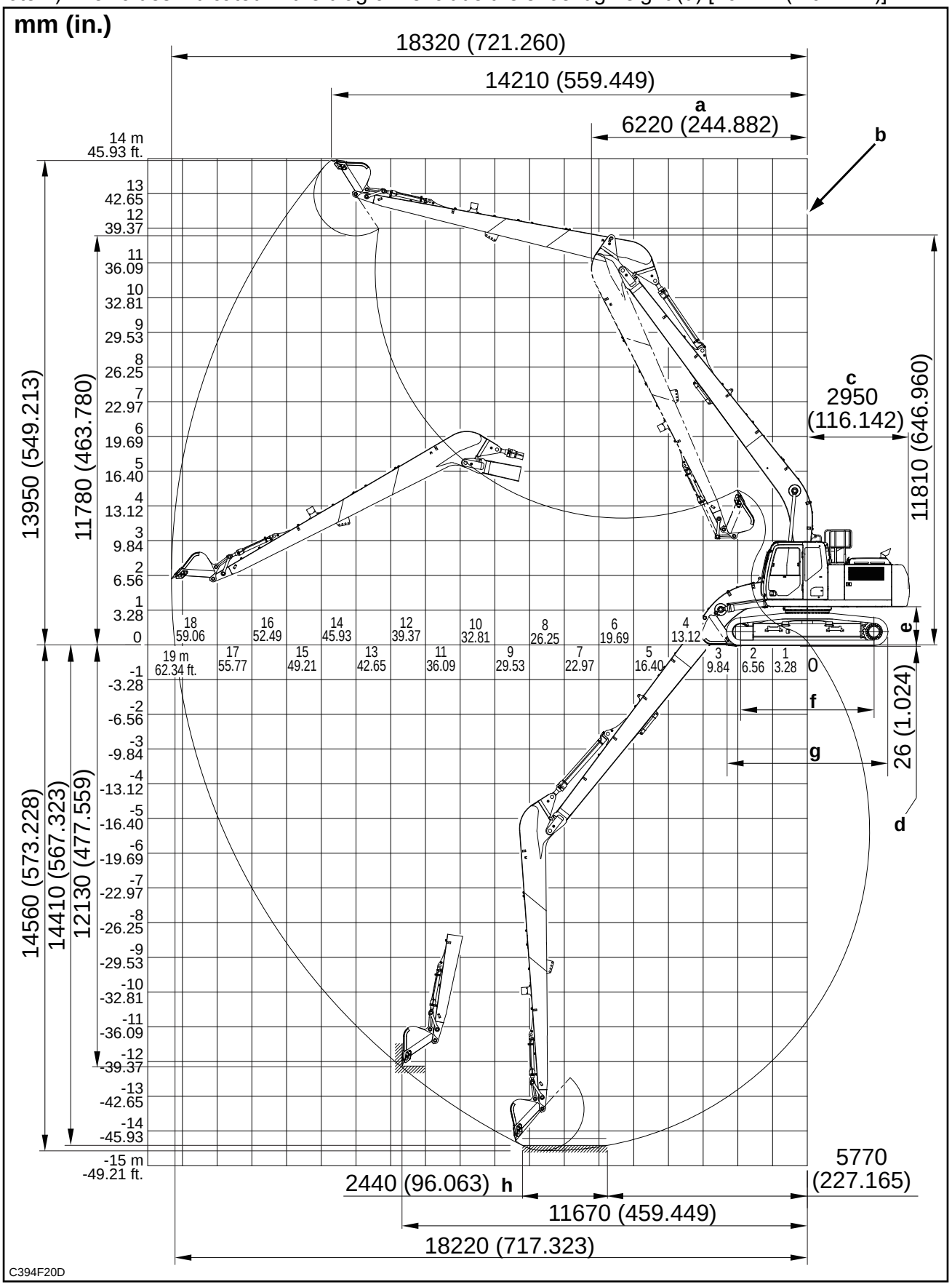
| | Part name | Weight [kg (lb)] |
|---|---|---|
| 1 | Travel unit | 271 (597.456) |
| 2 | Take-up roller | 99 (218.259) |

## 250X4 LF

Ultra-long Arm [8.0 m (26.247 ft.)]

Note 1) The values used in this document are subject to change without notice due to a design change or other reasons.

Note 2) The values indicated in the diagram exclude the shoe lug height (d) [26 mm (1.024 in.)].



## Main Unit-side Trouble

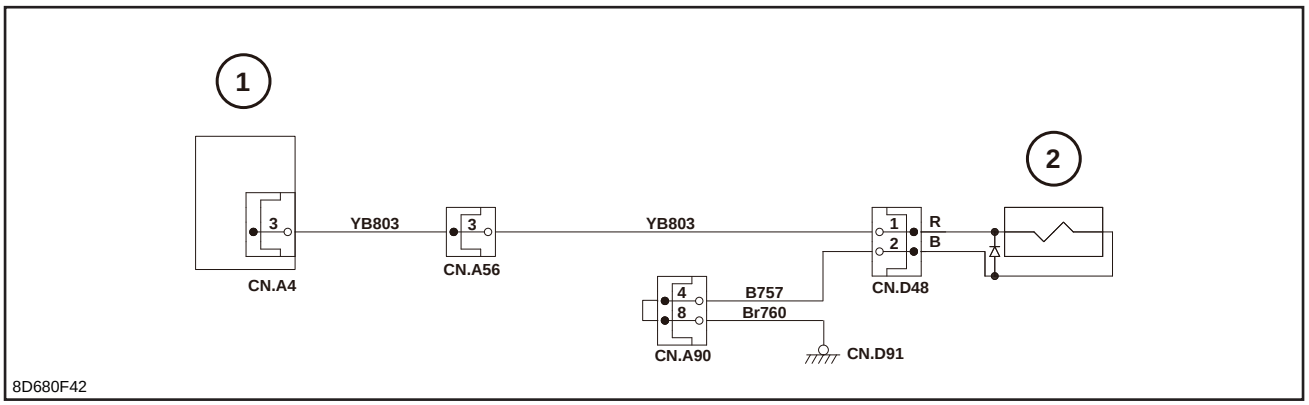
### Diagnostic Trouble Code: 7000 Pressure Sensor P1 Abnormality

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | 1. Turn the key switch ON.<br>2. Check whether diagnostic trouble code: 7000 is displayed.<br>Is diagnostic trouble code: 7000 displayed? | | Go to Step 2. | |
| 2 | 1. Inspect the connection status of each connector.<br>2. Check whether diagnostic trouble code: 7000 is displayed.<br>Is diagnostic trouble code: 7000 displayed? | | Go to Step 3. | |
| 3 | 1. Check the P1 pressure sensor voltage on the service support screen.<br>Is it 4.75 V or higher? | 4.75 V or higher | Go to Step 4. | When 0.25 V or lower, go to Step 8. |
| 4 | Inspect for shorts to the power supply.<br>1. Turn the key switch OFF and disconnect CN.D67.<br>2. Turn the key switch ON.<br>3. Measure the voltage between the ground and terminal 1 of the CN.D67 harness side.<br>Is it about 5 V? | About 5 V | Go to Step 5. | W430 harness defect (short). Replace. |
| 5 | 1. Measure the voltage between the ground and terminal 2 of the CN.D67 harness side.<br>Is it 4.75 V or lower? | 4.75 V or lower | Go to Step 6. | Y417 harness defect (short). Replace. |
| 6 | 1. Measure the voltage between the ground and terminal 3 of the CN.D67 harness side.<br>Is it 0.25 V or lower? | 0.25 V or lower | Go to Step 7. | BL440 harness defect (short). Replace. |
| 7 | The main controller is judged faulty.<br>... Replace the main controller. | | | |
| 8 | 1. Inspect the P1 pressure sensor.<br>2. Turn the key switch OFF.<br>3. Disconnect CN.D67.<br>4. Measure the resistance between terminals 1 and 3 of the CN.D67 P1 pressure sensor side.<br>Is it about 10 kΩ? | About 10 kΩ | Go to Step 9. | P1 pressure sensor defect. Replace. |
| 9 | Inspect for shorts to ground and disconnections.<br>1. Inspect for continuity between the ground and terminal 1 of the CN.D67 harness side.<br>2. Inspect for continuity between the ground and terminal 2 of the CN.D67 harness side.<br>Is there continuity? | | W430 or Y417 harness defect (short). Replace. | Go to Step 10. |

## Diagnostic Trouble Code: 7068 Pressure Sensor Boom-Down Pilot Abnormality

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | 1. Turn the key switch ON.<br>2. Check whether diagnostic trouble code 7068 is displayed. | | Go to Step 2. | |
| 2 | 1. Turn the key switch OFF.<br>2. Inspect the connection status of each connector for poor insertion and wiring terminal disconnection.<br>3. Disconnect each connector, and check for any wiring terminal abnormality. If there is no abnormality, reconnect the connectors.<br>4. Turn the key switch ON, and check whether diagnostic trouble code 7068 is displayed. | | Go to Step 3. | |
| 3 | 1. Check whether the voltage of pressure sensor is 4.75 V or higher at the service support screen. | 4.75 V or higher | Go to Step 4. | When 0.25 V or lower, go to Step 8. |
| 4 | Inspect for shorts to the power supply.<br>1. Turn the key switch OFF and disconnect CN.D71.<br>2. Turn the key switch ON.<br>3. Measure whether the voltage between the ground and terminal 1 of the CN.D71 harness side is 5 V or higher. | About 5 V | Go to Step 5. | WL435d or WL435 harness defect (short). Replace. |
| 5 | 1. Measure whether the voltage between the ground and terminal 2 of the CN.D71 harness side is 4.75 V or lower. | 4.75 V or lower | Go to Step 6. | LW406 harness defect (short). Replace. |
| 6 | 1. Measure whether the voltage between the ground and terminal 3 of the CN.D71 harness side is 0.25 V or lower. | 0.25 V or lower | Go to Step 7. | BW445d or BW445 harness defect (short). Replace or go to Step 8. |
| 7 | Faulty main controller | | | Replace the main controller. |
| 8 | 1. Inspect the boom-down Pi pressure sensor.<br>2. Turn the key switch OFF.<br>3. Disconnect CN.D71.<br>4. Measure whether the resistance between terminals 1 and 3 of the CN.D71 pressure sensor side is about 10 Ω. | About 10 Ω | Go to Step 9. | Boom-down Pi pressure sensor defect. Replace. |
| 9 | Inspect for shorts to ground and disconnections.<br>1. Inspect whether there is continuity between the ground and terminal 1 of the CN.D71 harness side. | | WL435d, WL435, or LW406 harness defect (short). Replace. | Go to Step 9. |

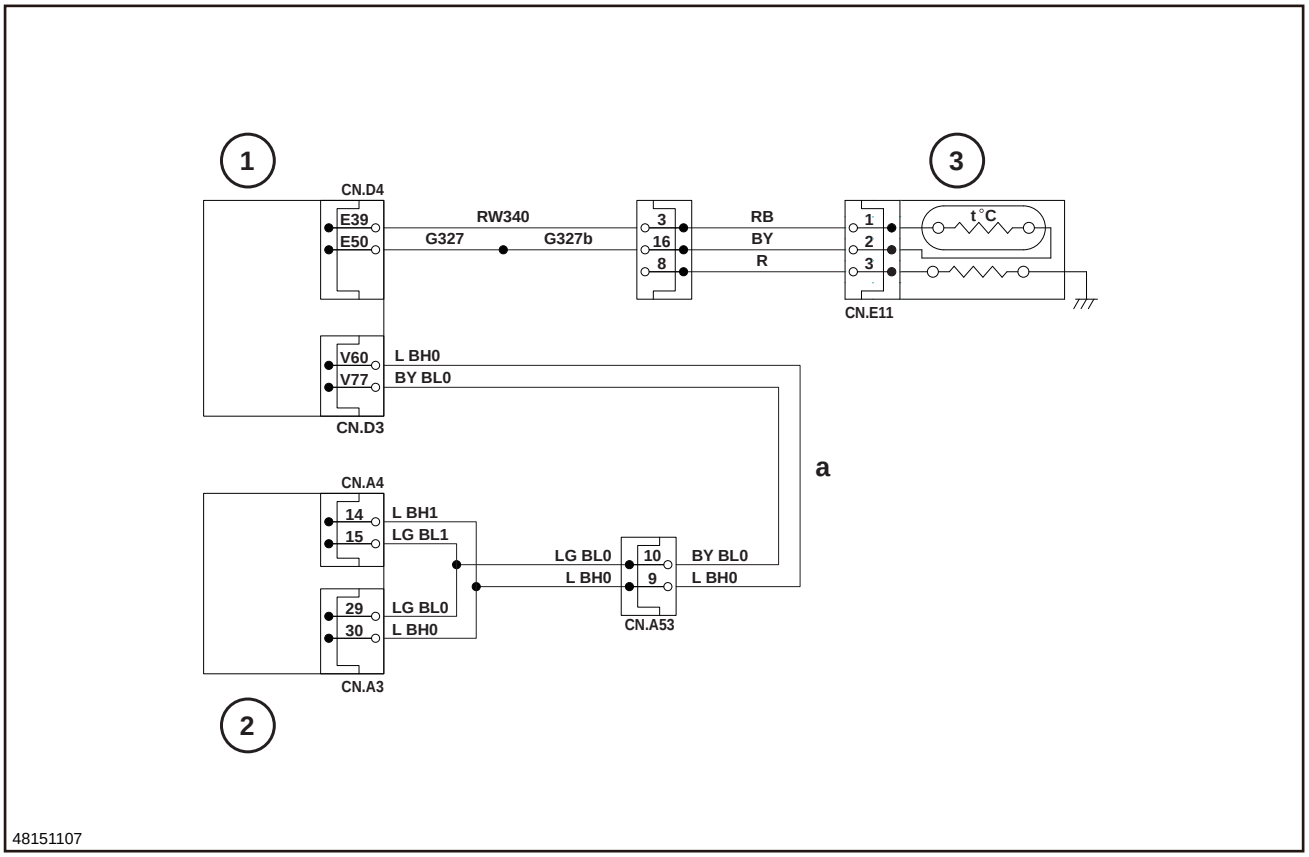
| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 6 | Inspect for continuity between the ground and terminal 2 of the CN.D48 harness side.<br>Is there continuity? | | Main controller defect. Replace. | B757 or Br760 harness defect (disconnection). Repair or replace. |




| | |
|---|---|
| 1 | Main controller |
| 2 | Solenoid (pressure boost) |

## Diagnostic Trouble Code: 7203 Travel Alarm Buzzer Abnormality

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | 1. Turn the key switch ON.<br>2. Check whether diagnostic trouble code: 7203 is displayed.<br>Is diagnostic trouble code: 7203 displayed? | | Go to Step 2. | |
| 2 | 1. Inspect the connection status of each connector.<br>2. Check whether diagnostic trouble code: 7203 is displayed.<br>Is diagnostic trouble code: 7203 displayed? | | Go to Step 3. | |
| 3 | Inspect the travel alarm.<br>1. Turn the key switch OFF and disconnect CN.D51.<br>2. Connect terminal 1 of the CN.D51 travel alarm side to the battery's positive, connect its terminal 2 to the negative, and inspect whether the travel alarm sounds.<br>Does the travel alarm sound? | | Go to Step 4. | Travel alarm defect. Replace. |
| 4 | Inspect for shorts.<br>Inspect for continuity between the ground and terminal 1 of the CN.D51 harness side.<br>Is there continuity? | | RY807 harness defect (short). Replace. | Go to Step 5. |
| 5 | Inspect for disconnection.<br>1. Disconnect CN.A4.<br>2. Inspect for continuity between terminal 5 of the CN.A4 harness side and terminal 1 of the CN.D51 harness side.<br>Is there continuity? | | Go to Step 6. | RY807 harness defect (disconnection). Repair or replace. |




| | |
|---|---|
| 1 | Engine computer |
| 2 | Main controller |
| 3 | Coolant temperature sensor |

| | |
|---|---|
| a | CAN communication |

## Diagnostic Trouble Code: 7401 Coolant Temperature Overheating 2

| Step | Action | Standard value | Yes | No |
|---|---|---|---|---|
| 1 | 1. Start the engine and perform a warm-up operation until the engine is fully warmed up.<br>2. Check whether the diagnostic trouble code: 7401 is displayed at the service support screen.<br>Is the diagnostic trouble code: 7401 displayed? | | Go to Step 2 | |
| 2 | Inspect the engine unit. | | | |